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ABSTRACT

This resource book profiles over 40 African female scientists and technologists. The women are presented as role models for young women to help challenge the gender biases that prevent girls and women from entering scientific fields. The profiles of the women employed in scientific and technological fields include photographs and excerpts from interviews. The book also presents current data on the number of women in scientific and technological fields, suggestions for raising those numbers, and a review of career opportunities in science and technology. A list of references and three appendices also are included: (1) Women in education, training and employment: selected African countries; (2) Entry requirements for professional training and education; and (3) Sources of information. (DB)

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WOMEN TOO
in SCIENCE AND TECHNOLOGY IN AFRICA

JAN HARDING and EMMANUEL APEA
with contributions by
Kabiru Kinyanjui and Eddah Gachukia

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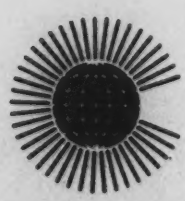

Commonwealth Secretariat

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WOMEN TOO
in SCIENCE AND TECHNOLOGY
IN AFRICA

A RESOURCE BOOK FOR COUNSELLING GIRLS AND YOUNG WOMEN

BY
JAN HARDING & EMMANUEL APEA
WITH CONTRIBUTIONS BY
KABIRU KINYANJUI AND EDDAH GACHUKIA

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Education Programme
Human Resource Development Group
Marlborough House
Pall Mall, London SW1Y 5HX

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Our sincere thanks are due to the persons - Ministry of Education officials and university teachers - who acted as local co-ordinators in identifying the women scientists and technologists, and helped to arrange the interviews for Mr Ali in the countries concerned.

We are especially grateful to the women scientists and technologists, themselves, who gave support to the project and time from their busy schedules, and to the organisations they represent. Without the willing collaboration of both there would have been no project.

WOMEN, TOO, IN SCIENCE AND TECHNOLOGY

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WOMEN, TOO, IN SCIENCE AND TECHNOLOGY

PREFACE

Commitment to the full integration of women into the development of the society in which they live has been expressed clearly by both the United Nations and the Commonwealth. Both bodies have prompted action plans which set out to remove the barriers to women's participation in development

The United Nation's Action Plan is expressed in "The Nairobi Forward Looking Strategies for the Advancement of Women" adopted by the 40th Session of the General Assembly of the United Nations in Resolution 40/108 on 13th December 1985.

A Commonwealth Plan of Action on Women and Development was prepared at the 1987 Harare meeting of Ministers Responsible for Women's Affairs to give substance to the Policy Statement on Women and Development endorsed by Heads of Government at the Nassau Meeting in 1985. The Plan of Action also received endorsement from Heads of Government at their 1987 meeting in Vancouver.

This booklet is a result of a study commissioned by the Education Programme of the Human Resource Development Group of the Commonwealth Secretariat. It is intended to make a small contribution to the implementation of the Commonwealth Plan and is addressed chiefly to those in positions to influence young women, their attitudes, self-perceptions and destinations, i.e. to teachers, parents, educational administrators and cultural leaders and to the young women themselves. It is concerned with women and science and technology.

INTRODUCTION

Science and technology shape our futures; they are essential to development - so are women. But few girls and young women become skilled in science and technology and are therefore excluded from participating in many areas of development.

The Commonwealth Secretariat has raised awareness of gender biases in science, technology and mathematics education in Africa through a regional workshop held in Accra, Ghana, in January 1987. This workshop identified out-dated stereotyped attitudes as one of the biggest barriers to women entering science and technology. It recommended that women already working as scientists and technologists should be publicized to serve as role models to girls in schools and to challenge the stereotyped assumptions of their teachers and parents.

The Commonwealth Secretariat has pursued this. Women scientists and technologists have been identified, interviewed and photographed. Tapes of these interviews have been used to create the profiles of women included in this booklet and to prepare a programme that will be available for use by local radio stations.

In the sections that follow we look more closely at the recommendations made for women and development, at the importance of science and technology for development, at the present position of women in science and technology and at what needs to be done to enable women to participate in development through science and technology.

Women are to be found, albeit in small numbers at present, in a surprising range of professions: they work as surveyors and architects, as engineers of all kinds - mechanical, civil, electrical, avionic and chemical - as well as in agriculture, medicine and academic sciences. They are in charge of communication systems at one airport, aircraft maintenance at another, a public electricity supply, the quality control in a national brewery, a brick factory and in senior positions in universities, hospitals, clinics and professional bodies.

But comprehensive and recent data on the participation of girls and women in science and technology in Commonwealth African countries are not readily available, as Section 3 shows. It is important to remedy this as, unless the position of women is monitored, there is no base-line from which to evaluate the effectiveness of measures adopted to encourage more girls and women to join those featured in this booklet.

SECTION 1: WOMEN AND DEVELOPMENT

The Forward-looking Strategies

The Nairobi 'Forward-looking Strategies' state "the advancement of women is without doubt a pre-condition for the establishing of a humane and progressive society" (page 15 para. 39). It is assumed that operational strategies for the advancement of women to the year 2000 will be governed by the objectives of the United Nations Decade for Women, namely: equality, development and peace.

The Forward-looking Strategies recognize that countries are at various stages of development and that each will have priorities based in their own development policies and resource capabilities but that, within these, "the integration of women in development should rank high".

The establishment of equality and peace are, of course, intimately bound up with the integration of women in development. The initiatives launched in 1988 hold promise for the progress of peace throughout the world; much work in reconciliation remains to be done if the immense expenditure of material and human resources on arms and defence are to be released for development.

In order to promote equality of men and women, the Forward-looking Strategies recommend that "Governments should ensure, for both women and men, equality before the law, the provision of facilities for equality of educational opportunities and training, health services, equality in conditions and opportunities of employment, including remuneration, and adequate social security" (page 19, para.54)

Governments are urged to set up appropriate machinery, at a high level of government, to monitor the impact on women of government policies and to collect, collate and publish statistics on progress towards the elimination of inequalities. "Research activities should be promoted to identify discriminatory practices in education and training and ensure equality at those two levels". (page 23 para. 81)

The importance is stressed of including in curricula, at all educational levels, examples and discussion of the contribution that women have made, and are making, to the economy. Teaching materials "should demonstrate clearly the equality of the sexes" and be "rewritten to ensure that they reflect positive, dynamic and participatory images of women ... " (page 24 para. 82,83)

This booklet is intended as a resource in the developments recommended above.

When considering development, the Forward-looking Strategies select a number of areas for specific action. Among these are employment, health, education, agriculture, industry and science and technology.

The Forward-looking Strategies emphasize the important role that women already play in agriculture, trade and health care in their countries. Development plans should recognize this contribution of women, build on it, and integrate women fully in training, management and decision making.

It is recognized that the high drop out rate of girls and young women at all levels of the education system must urgently be addressed. "Education is the basis for the full promotion and improvement of the status of women" (page 41, para. 163) "Measures must be developed, strengthened and implemented that will, inter alia, create the appropriate incentives to ensure that women have an equal opportunity to acquire education at all levels, as well as to apply their education in a work or career context." (page 41, para. 165)

In particular, "Encouragement and incentives, as well as counselling services, should be provided for girls to study scientific, technical and managerial subjects at all levels, in order to develop and enhance the aptitudes of women for decision-making, management and leadership in these fields" (page 42, para. 169). And "Extensive measures should be taken to diversify women's vocational education and training in order to extend their opportunities for employment in occupations that are non-traditional or new to women and that are important to development" (page 42, para. 171).

The Commonwealth Action Plan

The Secretariat Action Plan is based on the recognition of the crucial role women can and do play in development if constraints preventing their full participation are removed.

Since much of the work of the Secretariat Divisions comprises workshops, seminars, training courses and policy-oriented research, the Secretariat can see that women and development issues are adequately represented by including relevant topics in agenda, background papers and research studies.

Educational and training opportunities feature prominently in Secretariat collaboration with governments so the former will request the nomination of more women for awards, suggesting the establishment of targets, the monitoring of participation and the identification of factors inhibiting women's participation in awards.

In providing technical assistance, gender implications will be considered and monitored and more women will be recruited to the roster of experts and consultants held by the Commonwealth Fund for Technical Co-operation.

A Women and Development Committee has been established to monitor the implementation of the Action Plan. It will meet at least twice a year to review progress and problems, advise on the latter and report to the Secretary-General.

But the Secretariat serves national governments and the Commonwealth Ministers of Women's Affairs, at their meeting in Harare in August 1987, emphasized the broader role that national governments have in achieving the Commonwealth objectives for Women and Development. They agreed that each government should develop a national policy on women and development integrated into the National Development Plan, ensure the effectiveness of national women's machinery and provide special gender-awareness training programmes for senior policy-makers and planners.

Each Division of the Secretariat has examined its mandate in relation to women and development issues. One of the goals of the Human Resource Development Group is "to promote the advancement of women and their full integration as agents and beneficiaries of development in order to achieve overall development goals." The restricted access of girls and women to education and training limits their ability to contribute to development. To remedy this, attention is directed to factors limiting full participation in formal and vocational schooling, gender-stereotyping in curricula, gender streaming by subject and the recruitment of girls to scientific and technical education.

Every effort has been made to promote nominations of women for Fellowship and Training Awards. Few nominated women fail to receive an award, but increases in their number is slow. Most awards have been given in education, health and social services. Very few nominations have been made in agriculture (in spite of the important contributions that women make in this area) and virtually none in sectors with a scientific or mathematical bias.

The Commonwealth Science Council reports that it has "actively encouraged women's participation in its projects and activites as it recognizes that enhancing the participation of women scientists and technologists will strengthen the quality and reach of the application of science and technology, especially in the rural areas and in less advanced countries. However, a major constraint is the low representation of women in scientific and technological fields in member countries."

SECTION 2: SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

The basic survival, potential development and ultimate fate of a people depends, to a large extent, on their access to material resources, on their ability to utilize these for food production and trade and on their understanding of the consequences of their interactions with these resources.

In other words, survival and development is dependent on the possession and use of science and technology. [One cannot, of course, make such a statement without acknowledging that science and technology, used in warfare, also facilitates the ultimate destruction of peoples, hence the desperate need for peace between nations].

The Commonwealth Science Council sought advice from an 'Expert Group' on the role of science and technology for development. They based their recommendations on two assumptions:

(i) economic and social development depend on technology and innovation,
(ii) technological development depends on continuing basic science research.

The basic science envisaged was "that which had both a genuine connection with the real world and which clearly contributed to emerging technological areas crucial for development (p.2 'Science for Technology for Development', Commonwealth Science Council, 1984)

Fourteen areas of research crucial for development were identified, including, most importantly, agriculture, energy resources, biological diversity and genetic resources, mineral and water resources and remote sensing. The first four are areas in which women, because of the roles they fill within their societies, have much experimental knowledge and responsibilities. It will be a tragic waste of human resources if women are not fully integrated in the proposed developments.

In their comments on "Science management and organization" the Expert Group recommend nations "to popularize science both for their administrators and their public, and to produce appropriate local and regional materials that would make science both entertaining and educational while still relating it to pressing economic issues."

The importance of basic science education in schools and universities is emphasised. This needed "better teacher training, incentives, equipment and curriculum development so that science cannot only contribute more effectively to technological and economic prosperity, but can be seen to do so."

SECTION 3: WOMEN, TOO, IN SCIENCE AND TECHNOLOGY - THE PRESENT SITUATION

It has not been possible to gather comprehensive details of the position of women and girls in science and technology in Commonwealth African countries. In what follows we draw upon a few surveys reported in the last ten years and make reference to the situation in specific countries, mainly in East and Central Africa. This is not because they are necessarily representative, nor that they are unusual, but that the data were more readily available. It is hoped that readers will examine these and ask questions about the position of women and girls in their own local situation or institution.

Girls in School

Girls everywhere in Africa attend school less often and drop-out of school earlier than do boys. In Kenya, some improvement has been made from the position at Independence, when female enrolments, at 304,829, formed 34% of total primary enrolments; in 1979 the figure was 1,744,500 or 42% of the total (Eshiwani 1985). However, a higher proportion of girls than boys drop-out (26% as opposed to 7%) and a higher proportion of girls fail to qualify for the Certificate of Primary Education (71% of those sitting CPE in 1972). Eshiwani attributes the high level of wastage and drop-out rate of girls to a cultural and educational system which discriminates against girls.

While primary schools in Kenya are co-educational, most secondary schools are not. This gives rise to inequality of provision, for there are more government secondary schools for boys than for girls - in 1985 only 36% of total enrolments in government secondary schools were girls. More than half the girls in secondary school that year went to 'Harambee' or private schools. These have, reportedly, fewer facilities (many offering no science) and more poorly motivated teachers, with lower qualifications, than have government schools. (Kinyanjui, 1988 and Eshiwani, 1985)

Tanzania is attempting to equip girls' schools with more adequate science teaching, but as Table 5 (Appendix 1) shows, girls' schools with comparable facilities to boys' schools are fewer in number. For example, while 21 boys' schools offer physics as an Advanced level subject only 4 girls' schools do so.

It is not only in sex-segregated education that girls are disadvantaged. This is how a girl who had just completed her education in one of the most prestigious coeducational schools in West Africa reflected on her school experiences:

"In school we had a great number of girls doing arts and most of the boys and a few girls doing science. In the biology lab., even, you would see about 15 girls and 48 boys and in the maths class you would find only one or two girls and a great number of boys, so I really do think they are not encouraged to do science.

"My year at school had 40 girls and 12 did science for 'O' level, but only 4 went on to do it in the 6th form and none of us got very good grades. I think the teachers help the boys a lot more. If a girl asks a question maybe she's told to see the teacher after the lesson, but if a boy asks a question it's 'OK, lets go through this carefully.'

"There was this fashion in school that even if you knew the answer you wouldn't put your hand up - you'd wait for the teacher to ask you and they usually asked the boys and chose the ones who they thought would get the answer right so they could leave the topic and go on to the next. I would feel 'how ever am I going to learn this?' If it's a boy with problems they say 'you are a boy, you must do better, you must be able to do this' but if you're a girl they say - 'It's alright, you don't need this, you can go off and learn to cook and sew' and most of the girls really do go off to cook and sew."

Young Women in Higher Education

Women are present often only in very small numbers in engineering courses as is shown in Tables 1 and 2 for Zimbabwe, Table 6 for Tanzania or Table 8 for Kenya (Appendix 1). A few institutions such as Harare Polytechnic are beginning to recruit a higher proportion of women, but the 17 women enrolling in engineering in 1981 were only 5% of engineering entrants. Rather more women proceed to higher education in the pure sciences (see Tables 1, 2, 6, 8).

The position of women in medicine varies from one country to another: in the University of Dar-er-Salaam (Tanzania) the number of women enrolling in science varied from 32 to 68 in the period 1978 to '82 (Table 6) and those in medicine from 4 to 14 in the same period (no comparative figures are given for males). In Zimbabwe, for which only one year's data are available (Table 1), 83 women formed 25% of medical students enrolling in the University of Zimbabwe in 1981, whereas only 32 women (18%) enrolled for science courses. These differences are likely to be dependent on differing social needs and expectations and on possible organizational constraints within the institutions concerned.

Agriculture also shows variations; in the University of Zimbabwe 18 students formed 16% of enrolments in 1981 - figures comparable with science involvements but less than those for medicine. The University of Dar-es-Salaam, on the other hand, shows female enrolments in agriculture to be comparable with those for medicine (and only slightly more than for engineering and veterinary science) and considerably less than enrolments in the sciences. Data available for the University of Nairobi, Kenya, (Table 8) show agriculture to attract more female

enrolments (with male to female ratio 3:1) than do either engineering or veterinary science. In medicine, the intake of women increased five-fold from 1972 to 250 women in 1980.

Figures for Zambia are available for 1982. (Zard, 1985) reports that women constituted 26% of the total enrolments in science and paramedical institutions, while they formed nearly 40% in agricultural training. In that year 436 women (26% of the total) graduated from various technical and vocational centres; 20 of these were trained to teach technical subjects. For the first time two women enrolled in engineering courses.

Youth Polytechnics in Zambia are reported to train girls in a few traditionally female courses, while they offer boys a whole array of technical courses.

Foundations laid at school and social expectations affect the higher educational aspirations of young women. The women scientists and technologists interviewed for this project demonstrate the importance for their own achievement of encouragement especially from parents and from teachers.

Women in Employment

When Tables 4, 7 and 9 are examined (Appendix 1) it is apparent that women are making in-roads into science and technology careers. The majority are in nursing or medical/dental support roles, however. In 1981 women in Zambabwe (Table 4) formed 63% of medical assistants but only 9% of medical doctors, 71% of dental assistants and 15% of dentists. Only 4% of veterinarians and 2% of pharmacists were women, but they comprised more than 80% of nurses, physio- and occupational therapists and X-ray technicians.

Also in 1981, Kenya (Table 9) reported that females formed more than 70% of nursing and paramedical staff. Taking doctors, dentists, pharmacists and veterinarians together, women appeared as 13.7% of this group, 12% of scientists and agronomists, 8.2% of statisticians and 9% of science-based technicians.

For Tanzania, the data relate to 1980 and percentages are not given (Table 7). However, the figures again show the largest female employment to be in nursing. Life science technicians are reported separately from those in physical science, the numbers being 270 and 34, respectively.

So, although women are entering science-related employment in steadily increasing numbers, their distribution is dominated by two persistent stereotypes of female function: those of the caring and assistant roles. The accounts of individual women who are working in senior positions in science and technology in Commonwealth African countries will, it is hoped, help to challenge and change these stereotypes, so that all careers are seen as open to women and to men equally.

SECTION 4: WOMEN, TOO, IN SCIENCE AND TECHNOLOGY - WHAT MUST BE DONE?

Basic Education

If girls are to be able to benefit from formal science and technology education and training they must remain within schooling. Where expectations put pressure on girls to drop out of elementary school, and prevent them from proceeding to secondary school, these expectations must be challenged and changed. Positive support - moral, emotional, organisational and financial - is needed to enable girls and young women to continue their education.

Science and Technology in Basic Education.

It is a mistake to regard science and technology as subjects suitable only for secondary and higher education. The concepts of science and mathematics as difficult and formal areas of learning, and of technology as relevant only to vocational studies, must be changed. In the popularizing of science, recommended by both the Commonwealth Secretariat and the Science Council, its relationship to common experience and to everyday life must be rediscovered. Young children's ability to explore, observe, question, wonder and try out ideas (the basic processes of science) must be encouraged, and this achieved for girls as well as for boys, so that more formal science education becomes both an interpreter of their experience and an extension of it.

In the interviews with women scientists and technologists, which form the basis of the profiles in the next section, many of them made reference to the importance of their early success in mathematics both in creating a self-perception of being a good scholar and in laying foundations for future studies in science and technology. It is important that mathematics, too is presented in the early years through activities which are meaningful enjoyable for girls, as well as for boys and that every effort is made to challenge and dispel the myth that girls, as a whole, are LESS able than boys in mathematics.

Early technology education can be based in the design and construction of working models or simple play equipment, using commonplace materials and extended to relate to real problems in the local situation. A Unesco project, in the early 1980s, based in the upper years of elementary education in Sri Lankan schools, developed teaching materials to involve children in specific technological problems, among which were: the design of a more efficient paw-paw harvesting tool, the design of a two-way electrical switch (followed by seeking out a local electrician to discover where such a device is used) and the design of a compost in which fresh vegetables may be grown in pots to supplement the diet of a family without a garden. One of the basic objectives of this project was to break down gender-stereotyping of activities and so included, for all boys and girls, tasks relating to traditional work of both men and women.

Implications for Teacher Education

Teachers are members of the society in which they live and many hold the stereotyped expectations of men and women that exist in that society. Therefore, an important ingredient of teacher education is gender-awareness and an appreciation of the constraints on personal and national development that such stereotyping imposes. This booklet will be a resource in this process.

The changes to science and technology education recommended above have implications for teacher education. Institutions for teacher education should be among early targets in the popularizing of science. Workshops enabling teachers to work in the enquiring way expected of their pupils should be organized in the initial and in-service education of teachers. But whatever development is undertaken, gender considerations should be included.

Much curriculum development is needed and the most effective way to change what goes on in the classroom is to involve teachers in that development. If curricula are to be related to local conditions and needs, local teachers need to get together to pool experiences and ideas and to learn from each other. Strong science teacher associations should be encouraged with this in mind. Science teachers associations can take a lead in encouraging girls - The Australian Science Teachers Association, for example, has published a 'Policy for Girls Science Education.'

Women, Science and Technology and Work

The introduction of technology into areas where women work - in agriculture, in other industries or in sustaining the family - must be done in such a way that women are not displaced from a means of livelihood or from status positions. Example of negative effects on women of the introduction of different technologies are as follows:-

- a cooperative dairy project in India used male employees, depriving women who used to care for the cows and process the milk of any income they would have made from the products;

- the replacement of camels by trucks for nomadic people in Syria resulted in loss of status and other social benefits for the women who had, in the past, the responsibility of camel-care;

- the introduction of more sophisticated equipment in a French factory was thought to need male operatives and so women lost employment.

Women must be actively involved in whatever technologies are used in development.

The introduction of technologies provides additional opportunities for basic science education, as the scientific principles underlying the technologies may be simply explained for the women themselves and also

form a basis for science education in local schools. An example of such curriculum development was given, at the Accra workshop, from Sierra Leone. Women in a local area work with textiles and dyes. Kamara commented, "The amazing contribution of women to science activities and their receptivity to the adoption of new technologies challenge the curriculum developers."

Science and Technology: a Second Chance

Most educated women in Commonwealth African countries have qualifications in liberal arts and so-called 'soft' sciences. This bias should not be regarded as a handicap. It is possible for many of these women to convert to science and technically orientated careers, given appropriate conversion courses. Their broad background would make a special contribution to science and technology in development. Not all such women would wish to make the change, of course, but those with interest, imagination and some curiosity in science might be recruited.

Conversion courses of this kind have been offered in England and Wales since 1987 (*"HITECC - Engineering for a change"). They are of one year duration and are open to men and women. In the first year women formed 24% of those recruited. Special Women's Training Workshops have been set up in socially-deprived areas in the UK. In one year women with little background in science can qualify for a Higher National Certificate in computing or technical subjects. Ingredients for success seem to be a strong desire to achieve, collaborative working in a supportive group and encouragement of student control of learning.

A proposed Women's University in Kenya has indicated an interest in such courses and in remedial support courses for young women who have not done well in science education, but who aspire to science-based degrees at the university.

Women Scientists and Technologists: a Resource

Women who are already working in science and technology are important resources in several ways:

- their backgrounds and working lives can be an inspiration for young women in secondary education as they make decisions about their future;
- their working lives and achievements can help to break down stereotyped attitudes held by teachers and parents;
- the work they are doing can be used as starting points in the presentation of science education in schools.

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*HITECC (Higher Introductory Technology and Engineering Conversion Courses, National Advisory Body for Public Sector Higher Education, London, England).

It is for these reasons that profiles of women scientists and technologists are included in this booklet.

The accounts of their early lives show how important for them has been the support and encouragement of their families - parents, grandparents, older brothers and sisters, aunts and uncles. Some refer to supportive teachers. If more girls are provided with such encouragement to do well in mathematics and science, more will be enabled to follow the successes of these women.

Their stories also show how much they enjoy the work they are doing and how any initial resistance to their presence in the work place is quickly replaced by respect as they demonstrate their competence to do the job.

They are full of encouragement to girls to join them.

ARCHITECT

Aidah Munano, Kenya

Ms Munano has worked with the Ministry of Public Works in Nairobi since 1982. She holds a Bachelor of Architecture degree and, in 1984, registered with the Board of Registration of Architects and Quantity Surveyors.

Aidah is the only girl in a family of boys. Her father is an agricultural officer and her mother a teacher. She feels she had to show her brothers and friends that she could do all the things they could do.

Her interest in architecture arose in school where one of the boys took architecture and encouraged her to take it too. She looked at his work and thought it was interesting and different. Her parents did not know much about architecture but supported her just the same as her brothers. She finds people are surprised that a woman is an architect. At first she was angry that people did not accept her as a professional,

"You have to learn not to show you don't feel too happy about it!" She has to supervise the work of a lot of men. "Eventually they have learnt to accept me, but you have to prove yourself and show that you are actually capable of doing what they expect an architect to do," she says. She enjoys her work very much and has quite a lot of decisions to make.

"The most enjoyable part," she says "is designing something and seeing it develop. You do all the documentation and then see the actual implementation. You see the foundations laid and it goes up and up until it is all complete and you're ready to hand over to the client. In fact, the best moment is when you hand over the project."

The training is quite long, but can be completed between the ages of 23 and 26, and Aidah does not think it causes problems for women and marriage. "You're still quite eligible at 26!" She says. "It depends on the other person, if he found you in that career he should understand what the work involves."

There are some constraints on women: while she was pregnant she had to refuse the offer of a short course in Korea. She now has a son and when he was small she had to tell the office not to send her to distant sites where she had to stay overnight. During the day she has help in the home to care for him.

She has this to say to young girls: "The country needs professionals and women are just as capable as men. Do exactly what you want to do - what you feel fit for. If you are good at mathematics don't take any notice of people who say 'but girls don't like mathematics'. If you're good at it, then it means you like it, so don't be discouraged. If you like sciences, then go for them!"

MECHANICAL ENGINEER

Jane Gathogo, Kenya

Ms Gathogo has worked for the Ministry of Public Works since she graduated in engineering from the North East London Polytechnic, England in 1979. She also holds a diploma in Environmental Engineering from the Polytechnic of the South Bank, London.

She grew up as the fourth child in a family of eleven. Her parents were business people who were financially able to support their children's education. Jane attended a girls' school and says: "I had very encouraging teachers. There was a choice at school between physics and domestic science, but if they recognized any girls were good at physics they encouraged them to take it up and forget about the other."

Her interest in engineering was sparked off by reading an article in a newspaper. "It was talking about a lady at EAI that was brave, who had taken up engineering in the world of men, and that led me to thinking that I would like to do the same. Then we were taken from school to see the way EAI manufactures its goods and we met this lady at her work and I became even more interested."

She is glad she took up engineering and would make the same decision again. She likes her work, which is building services design for the Ministry of Works and especially enjoys the process of designing and seeing the project through to completion "like designing an air conditioning equipment and then it works effectively afterwards without any complaints, that is quite satisfying."

Promotion prospects, she thinks, are just as good for women as for men in the industry and she plans to take further qualifications. She did not experience any difficulties in training because she was a woman. "You get a few people who are surprised to see a woman working as an engineer and would prefer a man, but I supervise men and although at first they're not sure about instructions coming from a woman, once they get used to it they like it!" she says.

Ms Gathogo has two daughters: the youngest is two and is cared for very well by a maid while her mother is working.

"I would encourage girls to go into science and to break away from tradition that it is a man's world. They should do what they are best at without prejudice, " says Ms Gathogo.

ELECTRICAL ENGINEER

Rosemary Gitonga, Kenya

Ms Gitonga is Assistant Commercial Engineer for Consumer Services at the Kenya Power & Lighting Company Ltd., which she joined as a trainee on obtaining a B.Sc from the University of Nairobi in 1980.

She was the second born, and first daughter, in a family of 5 girls and 3 boys. Their father always encouraged them where education was concerned. "He used to tell us that he gave us education because that was all he could give us, he was not a wealthy man, so if we could take that we could use it for our future," she says, "so long as he could pay for our education he expected us to do what we could - both girls and boys."

Her father was not sure about her choice of engineering: "He let me do it and when I eventually made it he was happy about it, although he still, to today, feels that I should have been a teacher."

Encouragement to go into engineering came from a physics teacher at school. Rosemary attended a girls' school; their physics teacher was a man and, she says, "He gave us all courage, he said engineering was a good profession and that we could do it. In fact three of us ended up doing engineering. When we went to University he came to visit us to find out how we were getting on. We were very happy.

"Teachers play a very big part. Some are very bad because they don't bother with the girls when it comes to technical subjects or mathematics. If a girl has the talent they should find it and cultivate it. Since girls as well as boys are entrusted to them as teachers they should do their work properly!"

At university there was no discrimination in classes. "The only problem", she says, "was from my friends from home who were not studying engineering. Those were the ones who said women should not pursue this kind of thing - that it's not a woman's career. They even tried to tell my father not to let me do it, but he said he would let me do what I could do best."

Rosemary progressed through the Company from trainee to Fourth Assistant Engineer and so to her present job. Much of the work in those years was of the same kind, but in bigger and bigger concerns.

"You would work with the consumer as he developed his house or factory, design a power line, work out costs, supervise installations of machines, and monitor their working for efficiency so that he could get peak performance for the power he was using."

In her present job she supervises some 150 people, technicians at various grades and meter fixers (both categories include some women) and clerical staff.

"I was the first woman to be employed in this section, but I have worked with most of these people for a long time and they regard me as a supervisor, like any other man! "When the public came for consultations some are surprised to see a woman in this seat, but they become interested and ask questions. Those with daughters ask about choosing science and I try to show them what engineering is all about. The worst are those who telephone and refuse to accept I'm not the secretary!"

Rosemary married a veterinary surgeon a year after she graduated. Others of her engineering friends have husbands who are engineers, bank managers, artists - all kinds of professions. "My husband is very co-operative whatever I am doing; we organize and then he takes care of the family (two boys) when I am away and if he goes away I care for them. Here in Kenya it is easy to get good help in the house and reliable people to look after children.

"Yes", she says, "I would encourage any young girls to start thinking seriously about science, but to start early. Mathematics is the basis, so you've got to have courage in mathematics. There's a lot to do in engineering and women are proving they can do it better than many of the men!

"It's time engineering companies and magazines recognized this. The write-ups always refer to 'he'. I hope they will soon start including 'shes' and 'hers'!"

TECHNOLOGY LECTURER

Mary Wanjiru Wagaiyu, Kenya

Ms Wagaiyu teaches in the Kenya Polytechnic where she is a Lecturer in Workshop Practice and Technology in the Carpentry and Joinery Branch.

She grew up as the only girl in a family of boys in a rural area where her father was a teacher. Her parents, she says, treated them alike at home, encouraging them all to cook and do the washing up, so they were not very surprised when she chose to do something that generally boys do.

Mary says it all began when, as a small girl, she went with the boys collecting water or fire-wood. "I used to get mad because I had to carry mine on my back and the boys had made carts which they could just push along. They weren't keen to let me use their vehicles and so I decided to make my own. That's how I really got into woodworking."

She was very disappointed to find in primary school that only the boys did woodwork while girls did handicrafts and cookery. The girls' high school she attended did not have workshops, but in Form 3 she joined the science club and, whenever she had the chance, chose to make something in wood.

She goes on to say: "I got encouragement from a teacher who had come from Kenya Science Teachers' College (KSTC) and that is how I first decided that I was not going on for A levels, instead I am going to KSTC because there I could do some woodwork! At KSTC I studied physics and industrial education in a group that had four girls."

After teaching Physics, Carpentry and Joinery in a technical school for seven years she travelled to Britain on a scholarship to do a BEd course in Physics at Exeter University. When she arrived there she found they had workshops. She approached the Principal, told him she had done industrial education and was interested to change to a workshop course.

"He is the one who got in touch with the Kenya Embassy and they got in touch with the Ministry of Eduction here, so I

got to do a B.Ed course in Craft, Design and Technology. The lecturers there gave me a lot of encouragement, but there was only one other woman, a British girl, on the course and she was doing pottery, so in the workshops I was the only woman."

Back in Kenya people were surprised at her qualifications but she finds she has to establish her practical skill, usually with a jack plane, before a class will settle to learn with her. On the other hand, being a woman, she thinks, may help her to get short-listed in job applications at the present time.

She does not think that women in science careers have more difficulty in getting married, but that some men do have a problem in their attitude to educated women.

Mary has a young daughter; she says: "When I got the girl I went back to further studies. I feel she has helped me grow in my career."

Her daughter is interested in technical things, but she may not be able to follow this up in high school, since girls and boys are educated separately and girls' schools do not generally have good equipment. Mary thinks girls must be encouraged early to tinker with things and take them apart to overcome their timidity with equipment.

She gives the following reasons for wanting her daughter to go into technology:

"We need a lot of technologists in Kenya - we shouldn't have to import technology - and her job opportunities would be raised."

ARCHITECT

Adila Bashir, Kenya

Ms Bashir works for the Ministry of Public Works in Nairobi. She is registered with both the Architectural Association of Kenya and the Board of Registration of Architects and Quantity Surveyors. Her husband is a business man with degrees in Business Administration and Computer Science.

Her father is an architect, who now has his own business and she is the eldest child of four. Both her sisters and her brother are architects with the family firm. Her mother used to work as an accountant with the Central Bank.

The children used to help their father to make models for his work and he encouraged them in technical drawing and a lot of art. But a decision on what to do with her life was not easy for Adila. She says: "I did both science and arts. I loved drama, poetry and music. In the long holiday after year four I answered an advert for trainee broadcasters. I was trained for 3 months and offered a job at the end, but I decided I needed my A levels. I went back to school and worked for the Ministry of Information in my holidays. Eventually, because I did much better in my science subjects than in the arts, I decided to go into architecture. But I still do news reading and work free lance on documentaries."

She does not regret her choice. "It is very, very challenging," she said, " it is well worth proving that you, as a woman, can practise architecture as well as a man."

At the beginning of any project she works on there may be a problem, for she, the only woman, may be chairing a group of 15-30 men. "But", she says, " after a little while they get to understand you and know that you are a professional and you know your job. Then they forget you're a woman and it's plain sailing. You sort out problems as a team and at the end of the project they shake hands and say 'Thank you very much, we were happy to work with you'."

What Adila most enjoys is: " ... the design work and the field work - project management on site - having to work with a lot of people and dealing with personal relationships on site".

Adila and her husband have four children and the demands of the wife's work has caused some problems for them. One of her projects - the erection of two monuments - required a very tight schedule. She found herself working at weekends and each day until 2.0am. Her husband demanded: "Are you married to the job or to your husband?" They talked it out, Adila saying: "Look, this is my job and when you married me you knew this was the kind of work I would do. Either you join me or we have problems."

The solution they found was for him to go with her in the evenings to the site and help make the project a success. They have two maids: one for the house and one for the children, so they did not feel deserted.

"I would come back home about 5 o'clock," says Adila, "cook dinner, feed the children, wash them, tell the bedtime stories and put them to bed. We would leave about 7 o'clock after our dinner. I have trained all the children to sleep early and I go home at lunch time, feed them, check everything is OK and then go back to work. It's hard work, but its worth it. I would do it all over again."

Whenever she appears in public Adila wears the religious and cultural dress of a Muslim woman, in her case the black hejab from Mombasa. She says: "Sometimes it has been difficult for people to understand that you can be a professional woman and still maintain your culture and your religious values. Islam has always encouraged education for women. I cannot understand how some Islamic societies use the faith as a reason to push down their women. When you read the Koran you can see very clearly that Islam actually came to liberate the woman - to give her her freedom and to encourage her to be educated and take up professions. Why, the Prophet Mohammed said that education was so important that if you had to go to China to get it - man or woman - that's where you had to go!"

ELECTRICAL ENGINEER

Emma Kiilu, Kenya

Ms Kiilu has worked for the Ministry of Public Works since she qualified as an electrical engineer in the University of Nairobi in 1980.

She grew up as the eldest child of the family and says her parents just accepted she would do electrical engineering when she went to university. Emma enjoyed mathematics and netball most at her girls' school. In Form 5 the choices were maths, physics and chemistry or biology and because she did not like biology, she did the former. Then she was advised to put electrical engineering as first choice when she got enough points for the university.

She is stationed in Kisumu, representing the Chief Electrical Engineer, with responsibility for the public supply in that district. She supervises a work force of 150 which includes only 6 women. She has to make a lot of decisions that affect staff and projects. She says: "Surprisingly they have taken to me very well. If there are any complaints they haven't reached me yet!"

When asked if, given the chance, she would choose science again, she is a little cautious: "Yes and no," she says, "Yes, because so far I have enjoyed what I have done and no because perhaps in the future there may be disadvantages. For the time being the advantages are still winning!"

"What I enjoy most," she says, "is the responsibility the job carries. It really matters what you do - it affects a large population and when you finish you have something to show for the time you have taken and the money you have spent on it - especially if it will be a service to the public, then it is even more satisfying."

The disadvantage is in the attitude some people take because she is a woman. "Some of them are not willing to listen to you just from your looks before you say anything with your mouth! Others say I am in the wrong place. I had better go back and find out where I should be." The other disadvantage she finds is time. Sometimes when she is with people who may be important for her career she has to leave to get back home.

Emma is married to another electrical engineer who is very supportive - they have been together since college days and have a young daughter. A maid cares for the child while they work and they meet each day's problems as they arise. Because Kisumu is a small District Emma is able to travel to any part of it within a day and so does not have to stay away from home overnight. She feels the problems she faces are not especially because she is in science - they arise for any working woman.

She thinks girls are still discouraged from doing physics and maths but she would be happy for her daughter to follow her - or maybe to be an artist for a change!

BIOLOGIST

Professor Wangari Mathai, Kenya

Professor Mathai worked for some years in the Biological Sciences Department of the University of Kenya, eventually becoming the Chair of the Department, but since 1982 she has worked with the Green Belt Movement.

She grew up in a family of six in a rural area some 100 miles north of Nairobi. Her generation was the first to go to primary school as children. Her parents were peasant farmers, who had got primary education only as adults. They passed on to their children a great respect for education, and Wangari went on from stage to stage.

"Looking back," she says, "I really can't remember any single time when it was indicated to me that because I was a girl I am not as capable - which is probably one reason why I have been having problems ever since!

"When I went to the high school I caused a stir and for a girl to want to go to the university - that was unheard of! I didn't deliberately choose science. I was guided by my teachers. In the second year of high school the girls were divided into two on their science grades. I was doing all right in science, so went on with it. I think young children are very much influenced by adults at that stage."

"I finished high school when the country became independent and completely new fields were opening for everybody. I got a scholarship to study in the USA. In the women's college I attended the lecturers were very encouraging. Having graduated in Biological sciences I went on to the University of Pittsburg to do an MSc. I returned to the University of Nairobi for a PhD.

"I met quite a bit of resistance when I tried to get a job in the university - I could see that people didn't believe that a young girl could have a Masters, but they didn't question the boys who came back with me. That was the first time that I realised that ability was not the only thing that might count - that my gender was occasionally held against me!"

Her Ph.D studies involved micro-anatomy and took her to Germany where she had access to an electron microscope. Returning to Nairobi she rejoined the university as an assistant lecturer and completed her PhD in 1971. After this she obtained various promotions up to the Chair of the Department of Biological Sciences.

"What is interesting in all this," she says, "is that every time I would get any of these 'positions', because I was the first to get it, there would be such a big stir - it was really emphasising that they didn't believe I could do it."

In the 1970s Prof. Mathai became interested in environmental issues - she was studying Eastern Coast Fever, in particular the role ticks played in transferring the disease among the cattle. She noticed that the animals were much thinner than those she remembered from her childhood and realised that food for them was scarcer because the environment was much poorer. At the same time she was chairing the National Council of Women in Kenya. As they discussed problems facing women she concluded that many of these had their origins also in the degradation of the environment.

"I decided the best thing to do," she says, " was to go planting trees and educate people in an activity that they can easily carry out and identify with. Fortunately the tree grows very quickly, so you can easily solve some of the problems. That is how the Green Belt Movement was born. I have been with it now for the last 6 years; I have packed my academic bag and my laboratory work and now I am doing all my work in the field."

Professor Mathai recognizes that her life has not been easy: "First of all you are opening up new fields all the time and your life becomes very exciting, but at the time you are walking along a path that no woman has walked before and both the women and men think you are definitely out of your mind or a little too daring. It has not been a cup of tea but it has been a very challenging experience and in the end it is very, very satisfying to know that at least you have not succumbed to the obstacles."

She knows it has been hard sometimes for her three children to have a mother who is constantly hitting the headlines and being criticised. All three are in high school, with the eldest hoping to go soon to the university. Her only daughter is interested in science and Professor Mathai has this to say to girls in high school.

"It should be possible to get careers advisers to come to school - push your teachers to get this. You must be very honest with yourselves - and that is not easy sometimes - if you feel you can do science don't be discouraged by society, by teachers, by friends or by your own fears from reaching what you think you can do."

STRUCTURAL ENGINEER

Wanjiku Mumenya, Kenya

Ms Mumenya has worked for the Ministry of Public Works since 1983. She and her dental surgeon husband have two sons.

She explains that being good at maths got her into engineering. Her elder brother liked maths and she saw that her father was pleased with his success, so she wanted to be like him. At school, too, being good at mathematics earned praise from the teacher and presents at the end of term.

"I used to like that," she says, "so I pursued mathematics in forms 1 to 4 and passed very well, so I did maths, physics and further maths for A levels. The teacher called me in and advised me to go for practical aspects of mathematics and that meant engineering. I looked at the various branches and saw that civil engineering had lots of mathematics in it, so that's what I chose and was accepted. I chose also the structural bit because I actually wanted to see the mathematics at work!"

Wanjiku found she was the only woman in the Civil Engineering Department and the most difficult thing was to be taken seriously. "I had to work extra hard to prove that I am not just average, I am above average! And there's also this difficulty of being teased by men; they try to distract you to make you fail a little." She found she had to ignore all this and concentrate on her work and when that was finished and she got good results, then they respected her.

On graduating she worked first for a private company but many of their projects were based a long way from Nairobi and her parents did not like the idea of her living in a tent in the field, alone in the company of men. Another factor was she planned to marry. So although she had been trying to work up projects for registration, she transferred to the Ministry of Public Works which had more projects in Nairobi.

"This meant starting afresh on registration projects," she says, "but then babies came along and it took a bit longer, but in 1985 I had done a lot of design work and there was a big complex coming up 10 km from Nairobi so that I could

travel each day. I was attached to the site as resident engineer so that gave me a good basis for registration. I applied to the registration body, I was called for the professional interview and I passed. So now I am a professional engineer! My class mates may have got there three years earlier but still I don't have regrets because I have a lot of other good things with the family."

Wanjiku thinks prospects for promotion are good. She is a group leader with some hard-working junior engineers on the team and this encourages the whole group to do well.

She enjoys her profession. "There is always something to look forward to." She says, "I have done structures and now I want to design roads and maybe water-intake structures and so on. I have always felt the need to get to know more on timber - there is always something challenging you want to learn. It is a whole lifetime thing. So I find it's wide - it's interesting."

She has this to say to young girls: "I would advise young girls to pursue science subjects because in the long run there are more openings for good employment. Don't give up - have a go at it and its not difficult at all. If you give up in a science subject at the beginning you lose touch, so you must right from the start be interested, pursue it, and in the end you will find it comes easier than the arts."

QUANTITY SURVEYOR

Leah Thumbi, Kenya

Ms Thumbi graduated in Building Economics at the University of Nairobi, went to work for the Ministry of Public Works and three years later took her professional exams in Quantity Surveying.

She grew up as the sixth child in a family of four boys and three girls. Because, she says, her father was a teacher he encouraged them all to learn and get on. She looked up to her older brothers and sister, in particular a brother who became an architect. He encouraged her to think of surveying.

The subjects she chose in Form 5 helped: mathematics, economics and geography. "I didn't want to do all science subjects," she says, "I wanted to do something in between science and art and this fitted very well. I knew a few people who had done Building Economics so I thought it was quite a good degree for me."

She was the only woman in her year, but did not find this a problem as her teachers, colleagues and girl friends were all supportive. As she did not find difficulties with the studies, it all worked out quite well.

"The major role of a quantity surveyor," she explains, "is the cost control of the whole project as it is going on from start to finish, so that if you have cost limits then you can keep your project within those limits. We generally advise on all financial implications."

Within the Ministry of Works there are over 100 quantity surveyors, and 8 of them are women. "We fit in quite well together," says Leah, " it's very good generally working with men - they are very helpful."

She is married to an architect and they have four children, the eldest is twelve. She says of her husband: "I happen to be quite lucky because we are in the same line of work and we help each other. The surveyors' work comes through the architects first and so I get a lot from him. I also help him in the quantities in whatever work he does, so as far as his profession is concerned I advise him."

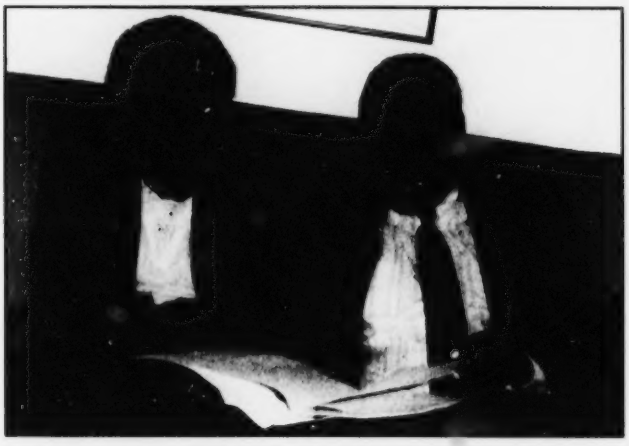
She says it is quite easy - not difficult at all - to bring up four children and work as a quantity surveyor.
"Because I had brothers and sisters ahead of me I saw how they were fitting in their work and home life, whatever profession they took, so I tended just to do the same.
"There may be some problems when you have to go on site for a few days, but somehow you always manage to organize yourself. For this kind of work we don't go out for more than three days or so - we generally go and come back the same day, so we manage. You take over where you left off."

She finds promotional prospects no different because she is a woman: the men who left college with her are at the same level, professionally, as she is:

"Quantity surveying is a good profession. It's flexible - you can organize your time better than, for example, if you are a doctor and it can be very well paid."

METEOROLOGIST

Ms Mutuli works for the Kenya Meteorological Department and also presents the weather on television. She has a B.Sc degree in meteorology from the University of Nairobi and a Masters degree in Computer Systems Applications from the University of Washington DC in the USA.



Winnie Mutuli, Kenya

She grew up as the eldest girl in a family of five boys and five girls.

"My father was very hard-working," she says. "He encouraged us all to work hard. Most of us have gone into science; my elder brother is an army doctor, the second is a lecturer in Mechanical Engineering at the University, the next is in agricultural science and my younger brothers and sisters are in nursing, one in the BSc programme at university. The youngest is in high school and we hope she will be a scientist too."

Her father hoped she would be a doctor but Winnie says: "I didn't quite fit into biology - all that blood and cutting insects - I didn't like that, so I went into mathematics, physics and chemistry. I was hoping to be an engineer, but there was a lot of competition for places so I ended up in the Bachelor of Science programme. In the first two years we studied pure and applied mathematics with physics and it was only in the third year I came across meteorology - it looked an attractive option. We did the theory side at university and then did a practical course for six months when we learnt forecasting techniques. I have since been on a course at the Kenya Institute of Mass Communications run in conjunction with the UK Met. Office. One of the BBC weather presenters, Bill Giles, was a tutor on it."

She often meets people in the street who think they know her. When they realize she is a weather presenter they complain how wrong the forecast is, but they are usually good-humoured.

"People are not very surprised to see a woman in the job," she says, "they think of the glamour and not the science - they seem to expect a woman."

The Department has just become computerised: "We use computers mainly for plotting weather charts - it has really facilitated this operation. We are now able to get the forecasts out earlier and they are more accurate.

"A panel of meteorologists prepares the forecast, led by the one on duty for that day. We look at the weather and discuss the reasons for any discrepancy in our earlier forecasting. Then we discuss the present charts & assess possible developments, making a detailed forecast for our country.

"The television forecast is not the only service the Weather Bureau gives. Civil Aviation is an important client. We have to tell the pilot beforehand what kind of weather, at what levels, he may encounter during his flight, so that he can plan his route. If there is cumulo-nimbus cloud at 40,000 feet he will need to avoid this as it is associated with very strong winds which can tear off an engine!

"We also give marine forecasts, locating tropical cyclones, estimating the height of the sea waves and strength of winds."

Winnie was a little uncertain about meteorology as a career at first, but now she is really getting to like the job - "It's not well paid, but it's satisfying," she says. She has a two year old son who stays with a maid while she is working.

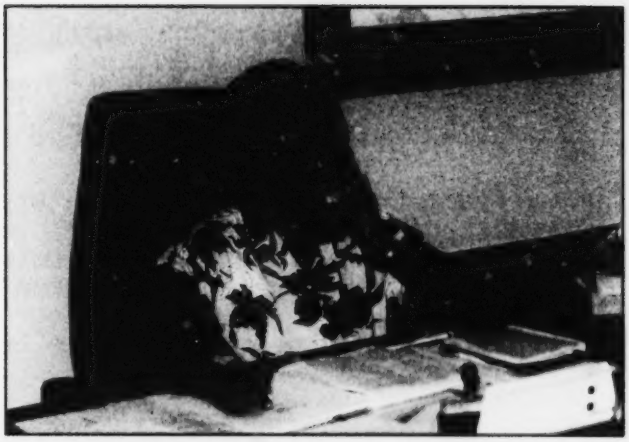
"When I go home late he's perhaps asleep, but mostly I get time to spend with him. Maybe just now he has got more used to the maid, but he knows I'm his mum. Sometimes when I want to get down to some serious work like preparing for a seminar or for a paper I am going to give, he's a nuisance. But I love him all the same!

"I would encourage girls never to drop out of school," she emphasises. "They should do what they feel they can do and do it well, so that they become financially independent. It's still a man's world and they need to be able to survive. Sometimes I sit back and think that, as a single parent, if I had not done what I did I would not be in a position to care for my son the way I am doing now."

MAINTENANCE MANAGER

Ms Munyagi is responsible for all maintenance at Dar-es-Salaam Airport. She has a B.Sc in Electrical Engineering from the University of Science and Technology, Kumasi, Ghana.

She grew up in a rural area in the north of the country near Lake Victoria. She was the first girl in a family of nine.



Margaret Munyagi, Tanzania

"I had a purely varied rural life," she says, "a peasant life. My parents were farmers. They encouraged us to go to school; it didn't matter whether you were a boy or a girl. Education was a way of getting a paid job.

"For Forms 1 to 6 I went to a girl's school. I had a very good talent for mathematics and they encouraged me very much. Everybody seemed fascinated as I took part in contests, representing the school or as an individual. Then I went on to do mathematics, physics and chemistry at 'A' level and when I finished secondary school I went into engineering subjects - things just rolled automatically - I don't remember choosing.

"I went to Ghana to study as there was no engineering faculty in the university at Dar Es Salaam, I think it started up the year after. We were really intended to go to Britain but there was some trouble about sitting another exam and so the Government said 'No' and sent us to Ghana. My mother was sad that I was going away for 4 years but my father was fascinated that I was going to do all this engineering work. They didn't know, I think, that it was generally work for men.

"When I returned I was interviewed by the Daily News as I was one of the first two women engineers in Tanzania. My mother got hold of a copy so the village was very excited and very happy that one of them had made it to hit the headlines!"

Margaret has seven engineers working for her! 2 civil engineers, 2 mechanical and 3 electrical and two are women. Below them are about 200 technicians and labourers in the different fields of engineering. "Generally," she says,

"they respect me as the boss and things go well. There have been one or two cases where workers have been difficult and I have wondered if this has been because I am a woman, but when I have followed it up I find they are just the same in another job with a male boss, so I've no cause to think my being a woman affects their work.

"The Airport Commandant is not a technical man so I make all the important decisions as far as technical matters are concerned. This covers the maintenance of equipment, the new technologies, whether we employ computers, how we increase efficiency, making a budget and the development of new projects. My decisions as an engineer are accepted and we try our best to implement them.

"What I enjoy most is the challenge of the work, and the satisfaction of working with men; there were men at the bottom and men at the top and you are a woman making your way surrounded by men. It gives me a lot of pleasure working here, being technical and using my knowledge."

Her husband is also an electrical engineer who is in charge of the electrical side of the Ministry of Communications and Works. "He was nagging at me to register with the Engineers' Registration Board and to join the Institution of Engineers (he, himself, is a member). So, thanks to him, I have done this."

They have three children: a girl and two boys. A maid helps in the house during the day. "But she leaves at 4," Margaret explains, "my husband gets home about 3, so he looks after the children and sometimes gets the meal as I don't get back until 5 or 5.30. If I have meetings and when I'm called out at nights he has to look after the children in the house. He's a great chap to me and he has been understanding and maybe without that life would not have been as easy as it is to me."

She would like to get further qualifications, perhaps doing a Masters degree in Electrical Engineering or in Management. In three of four years' time when the children are older she will do this.

Her message to young girls is this: "I would strongly encourage them to go into engineering as there's nothing special in it for men. If they are good at mathematics and science they will have no trouble. People may tend to think they can't do it, but women have already proved them to be wrong."

AIRCRAFT TECHNICIAN

Ms Mollel is a technician with Air Tanzania. She holds a Diploma in Aircraft Maintenance which she obtained after spending two and a half years with KLM in Holland.

She grew up in Arusha, where her father is a farmer, in a family of five boys and three girls.

Elizabeth Mollel, Tanzania

"My brothers are the people who made me want to do something different," she says, "because they used to be car mechanics, so I grew up in a family which was doing work which made me feel I wanted to do something different.

"My parents were very encouraging when I wanted to work with aircraft. The other people in the village kept their thoughts to themselves and waited to see what would happen!

"There were just two girls and 24 men on the course in Holland. It was new even for KLM to take women. They, too were watching us, waiting to see how we were doing. Even the teachers were looking to see what we would achieve. Eventually they came to accept that we could do it. The course was in English, so we didn't have to learn Dutch - we tried for two weeks but then gave up!

"We did very well on the course, got our diplomas and we are both back working for Air Tanzania, where we are the only girls, still. We are working hard to get our full licence. I take my exams next year.

"I work both in the workshops, where we repair instruments and check systems in a major overhaul, and in line maintenance, where we work on aircraft which come in with problems. We see that we are equal with the men - we are doing the same things. In our field you just have to work hard - you read and do your exams well and then you get your licence. Nobody is going to hinder you getting your licence. So, if I try hard I can do anything!"

Elizabeth has a two year old daughter. The baby's father is also an aircraft technician who works with air frames and engines. He is very supportive. "He is really good because he helps me a lot with the child. He helps me with the

washing up, feeding the child, putting her to bed and so on - everything. I respect him very much," she says.

"When the girl grows up I will encourage her, I won't force her, but if she wants to do something similar to what I am doing I will tell her - go ahead!"

TECHNICAL MANAGER

Elisipha Kinasha, Tanzania

Ms Kinasha works for the National Housing Corporation, managing a brick factory which has a capacity of 10 million bricks a year. She holds a B.Sc degree in Civil Engineering from the University at Dar-es-Salaam.

She grew up in the Arusha Region in the northern part of the country in a family of ten - six boys and four girls. Their parents never went to school - they only learned to read and write later - but they were determined their children should be educated.

Elisipha says: "When I was in high school I did physics, chemistry and mathematics. The Minister of Education sent his officers to the secondary schools which were teaching science subjects to persuade the girls to take engineering. They said we could manage as well as the men. So 3 girls went for engineering from the class above me and the following year we were 5 girls who tried to see if we could manage it.

"By that time most of my brothers were in university and they were very encouraging and supportive. At first I thought I would do architecture, but there was no course at the university at that time, so I did engineering instead.

"My parents were happy but a little anxious when I told them I was doing Civil Engineering - they thought that was to build and lay bricks and blocks yourself and they asked me if I could really pick up a block and arrange it to build a house. I told them that if I graduated as a Civil Engineer I wouldn't have to do that - I would supervise and oversee."

When she completed her course she had no trouble finding a job as they were allocated by the Ministry of Manpower. "When we were in the third year," she says, " we all got forms to complete to say where we wanted to go and then in the fourth year we got our postings."

Elisipha entered employment with the Housing Construction as a site Engineer for the construction of a factory. She progressed to Production Engineer and then to Technical Manager. At first there was no other woman on site and the

daily-paid labourers found it a great joke and talked loudly about her work. They soon got used to her, however, and she came to enjoy her work very much.

The job she is doing now could be carried out by someone with qualifications in Civil, Electrical or Mechanical Engineering. "It is a very responsible job," she says, "I am the head of a department which is almost the corner-stone of the factory. The Technical Department supports all the other departments and they depend on my decisions.

Answering the interviewer, she dismissed the suggestion that girls who go into science do not find it easy to get a husband. "I think getting married is an individual decision - if you want to marry early, then you can do so. If you don't, then you can wait. I married a month ago - my husband is a doctor and he's very supportive. He knows and accepts the work I do."

If she has a daughter she would like her to become an architect. She has this advice for young girls:

"I want just to advise them not to be afraid when people from outside start saying that these science subjects are hard and it is not possible to do them when you are a girl. I think everything is possible nowadays and many girls are in all fields.
I don't think there are any fields which are lacking in girls now."

GENERAL PRACTITIONER

Dr. Orpah Taderera, Zimbabwe

Dr Taderera has had a varied life. This is how she tells her story:

"My father was from Zimbabwe but he went to work in South Africa where he met and married my mother who was a Zulu. I grew up in South Africa, trained as a nurse and came to Zimbabwe with my father's sister in 1967. I got a job as a tutor in the School of Nursing in Harare and decided to stay in Zimbabwe as I had many relatives here. I met Joe Taderare, we got married and he soon left for the United States. I eventually joined him there and when we got to New York I was interested in doing designing - I love making clothes - I went to the headquarters of Simplicity Patterns and got a job. I rushed home, very excited, to tell my husband.

"At first he said nothing, but then questioned why I did not want to build on what I had already done, develop the nursing in some way. I wasn't very chuffed, but he used to be so dominant in my life that I listened to him and went to the University of New York to do a Human Biology Degree which I finished in 1976.

"I came back to Harare the next year with our two children and tried to get back into the School of Nursing. I found there was no chance of getting a better job and so I decided to go to the local medical school!

"I got in without any difficulty, but there were only 4 black Africans, all women, in the class of 60. Apart from three Indians all the others were white. I didn't get any bias - I think staying with black American Women helped me a lot because even if there would be any bias they refused to be discriminated against and when I came back from the States I just had that attitude.

"I qualified as a doctor in 1983 and worked at Harare hospital until 1986. My husband was tragically killed in 1984; he had only been able to return to live with us three years before and I wanted something to be a memorial to him. So the idea of a clinic was born. I obtained this

building, converted it and it's called the Dr. Joseph Taderera Memorial Clinic. It is in memory of his good work for the nation and as a husband and father of my children and for his inspiration, because I think if I had not married Joe Taderera I would not be a doctor today.

"I enjoy working here very much. I do my general practice from here but I have 13 beds in the clinic which consultants use. They leave patients in my care; I do my rounds in the morning and report to the consultants when they come. I am now combining Human Biology, nursing and being a doctor and the combination is working out very well. I am very pleased about it."

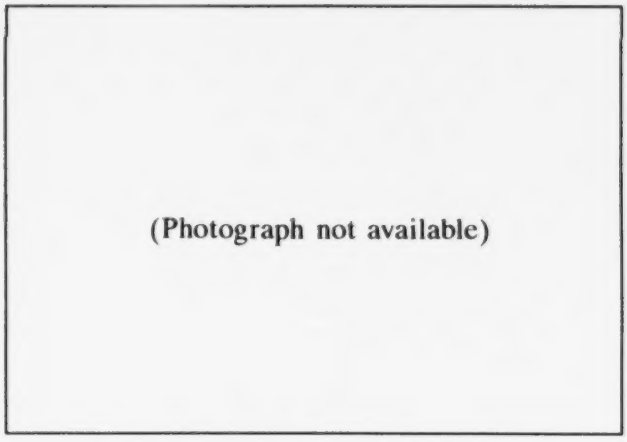
Dr Taderera hopes one of her children will qualify in medicine or pharmacy so that their father's name will stay in the family.

"The two children are very supportive; they are working very hard and doing very well at school. This is why I always say to mothers, whether they have a husband with then or not, you cannot use children as an excuse for not making progress in life. There is no limit and no end to education. I have done this and other things in life without a husband with me for most of the time, but with the children. They are just very well-balanced children - it hasn't affected them at all.

"There has been a tremendous change since independence in the way women dress, the way they carry themselves, and the way they have become independent. There are so many careers for them and they are doing very well."

ARCHITECT

Ms Maboreke joined the Ministry of Public Construction and National Housing of Zimbabwe in 1983 having obtained a B.A. (Hons) degree in Architecture from Kingston Polytechnic in London, UK, and successfully completed Parts 1 and 2 of the RIBA (Royal Institute of British Architects) professional examinations.



Gertrude Maboreke, Zimbabwe

Gertrude grew up in a rural area where her mother still works on the land. She was above average at primary school and went on to boarding school for secondary education. "When I finished high school here in Zimbabwe - Rhodesia that was - I was going on to do a BA degree at the University of Rhodesia, but because of the conditions during that time I couldn't get funds to go to college. But I had a cousin in England who invited me to go over there to see what I could do, as I had three A'levels and nine O'levels - that was good enough for any course. I stayed with her and took a job as a general hand at the Royal Institute of British Architects. Before then architecture was only a word in the dictionary for me. But there I saw architects coming to conferences, exhibitions and to do exams and I said to myself that I could become one of these architects as well. The course was not available at home and it would be a good idea if I go back with something to be of use in the country."

When she wrote home about this she had a reply from her younger brother, on behalf of her mother, raising all kinds of objections because in Rhodesia the profession was not open to blacks, who were expected to go into teaching, nursing or social science. However, she got a place at Kingston Polytechnic, where she was the only black student and one of a small number of women. She did well and continued to work at RIBA in the vacations. There she got to know a British architect who had contacts with Nairobi. He arranged for her to be attached to a Kenyan architect for part of her practical training.

On site in Nairobi she was first taken for somebody's daughter who was visiting. But then they questioned "Can you actually do this?" "can you do drawings?" "Can you supervise constructions?"

"It wasn't really downgrading," she asys, "it was just curiosity, surprise and interest at that time. I had to adjust to working with boys all the time when in England. We worked in groups and each had one girl to 6 or 8 guys. You had to go out on site, climb buildings and measure things and sometimes it was cold but you had to live like one of them and not to say - I am a girl and I can't do that. I had to overcome that feeling that had been inbred in me and get it out of myself!"

Because people with technical skills are in such short supply at present in Zimbabwe she finds women are welcomed and promotion prospects are good.

"You have to be good at your job and be sure of your facts," she warns.

"Building contractors are looking for any way to save money. Initially they will try really hard to exploit the fact you are a woman, thinking you are weak and that they can sweet-talk you into not doing something. But you have to be firm and stick to your contract documents and when they know that you mean it they come to respect you."

She has a two year old son whose father is supportive of what she is trying to do. She says:

"It's actually a relief having a child to look forward to after a day's work. We play or talk or go for a walk - pleasant things in life which is not just work. If I have to take work home then I make sure I give my son the time he deserves from knocking-off time. We eat, we play until such that he wants to go to bed. Then I have the chance to do the extra hours of work."

CONTRACTS ENGINEER

Jean Madzongwe, Zimbabwe

Ms Madzongwe works in the Construction Department of Generation and Transmission with the Zimbabwe Electricity Supply Authority.

"A contracts Engineer supervises, controls and monitors all contracts undertaken by the Construction Department," she says, "You keep in touch with engineering, the technical aspects and the financial situation on contracts. The ones I deal with are mainly transmission and sub-stations."

Jean came from a family with 6 children- 3 boys and 3 girls. Their parents had both been teachers and so encouraged them academically.

"In fact," she says, "when we had school holidays only the first day was free. After that we had to sit down and write a schedule - a programme of what subjects we were going to tackle and study during school holidays. My parents had the foresight to see that science was the future. So we were all encouraged into scientific fields."

Jean says her father knew she wanted to do something different or unusual and told her about industrial engineering. She was sent to the USA and studied for a BSc degree in Industrial Engineering at the Fairley Dickens University in New Jersey.

She enjoyed the breadth of the degree, specialising only in the last two years of the four year course. She met her husband in America. He approves of what she is doing and helps in the care of the children - a boy of 3 and a baby girl. If she has to be away overnight her mother looks after the baby, but their son stays with his father. During the day they employ a baby minder.

"I love being a mother," Jean says, "It does't really affect my job and I think to me my family has always come first, especially while they are so young. I do not think that any woman should feel that you have to stop giving up being a mother in order to pursue a career. I think that you can do the two together quite successfully.

"What I enjoy most about my work is seeing the projects materialize, when I can see the end result, to go there and see the power station and feel I am part of that - I make it happen."

She meets some problems at work because she is a woman but says: "There has got to be a change. Somebody has got to be prepared to be the one to stand there and help women get accepted in these fields. I feel I get encouragement so I stand there and I say OK I will stick it out and fight. Sometimes I feel a coward and just want to run away, but those moments come not very often. Most of the time I feel very determined."

She thinks some men feel threatened by educated women, but they would make bad husbands anyway!

She discusses incidents with her husband and her father, who tell her how a man's mind thinks so she can counter some of the situations. She finds if she goes in with a firm but pleasant approach to do a good job, she is accepted with respect.

AIRCRAFT INSTRUMENT TECHNICIAN

Agnes Kunaka, Zimbabwe

Ms Kunaka is near the end of her 5 years training with Zimbabwe Airways to be an aircraft technician. She has been trained in two departments: the avionics overhaul section where instruments such as air speed indicators, mach meters and vertical giros - all the instruments in the pilot's panel - are taken for routine overhaul or for repair and the avionics hanger where emergency repairs are made for in-flight aircraft.

Agnes explains:

"The aircraft comes in, say, from London or Frankfurt and it has got some snags. It's taken to the avionics maintenance hanger and you get to work. You get your manual, you read your set of diagrams and then you deduce where the problem might be. For example, suppose the pilot has had trouble with the flight director - the system that tells him where he is going - the first thing that comes to mind is that the vertical giro may be wrong. So you change the vertical giro, replacing it with a serviceable one. You do your round and think it's working OK and hand the plane back.

"You have to work fast, to get it done in the turn-round time or the airline loses money. You have to think fast and work fast whatever the conditions. There may be heavy rain or lightning but you take no notice - the pressure is very great. But I enjoy the challenge of the work and the satisfaction of seeing the aircraft fly. I like to know I can do what has always been a man's job. We have annual reports and they think I'm doing alright.

"I haven't really had trouble with the men. At first they try to discourage you but as soon as they find out you are determined they will accept you and try to encourage you. Sometimes they're too helpful and try to do things for you and you have to say no, I came here to do a job.

"I'm the third girl to be trained here. The others are working as qualified technicians. They get the same amount of money as the men, they work the same hours and do the same job as the men do. I don't think a woman's prospects

for promotion are less. Nowadays your qualifications, your ability and your production of work - these are the things which normally count in promotion."

Agnes grew up in a rural area where her father had a small farm. Both parents treated sons and daughters just alike.

"Our father never used to say that because you are a woman you are not going to hold a plough," she explains, "he was more likely to say - because you are my child you are going to hold the plough the same way as that other boy is doing! And when we were back from the fields my mother saw we all shared in the chores. A man was supposed to cook or to wash the clothes. If it was your duty that day you would do it, whether it was my brother or me or my elder sister. They gave me a very good foundation, so when I saw the avionics advertisement while I was doing my 'A'levels I said 'Wow'! I think I'll try this because my father will be really, really proud because he knows I can do a man's job as well as the man can do it."

The men from her home area frown at her, she says, but some of the women, although they are old and have had no education, look at her with pride.

"They are just objective in their thinking. They look at me, admire me and encourage me. Most of them would say - I pray you are going to have a very successful future."

She thinks teachers are often responsible for discouraging girls by not positively encouraging them. She says:

"I have never really met a teacher who said - you are a girl, I want you to be an engineer, or I want you to be a good electrician. They say this to the boys.

"I think that young girls should work really hard to pass their examinations. That's the first step - get qualified and then put your head up, shoulders straight and get determined. Once you are determined your future is bright and swell."

PROCESS & TEST ENGINEER

Siphiwe Musa, Zimbabwe

Ms Musa works for Air Zimbabwe. She has a B.Sc degree in Organic Chemistry from Cambridge University and a Masters degree in Metallurgy from the University of East Anglia, both in England.

Siphiwe was the last child of her father's first marriage - she says she was his favourite. He included her in everything, teasing her that she must be a boy because she was not so beautiful to look at. But she was top of her class in primary school and also in Forms 1 to 4.

She says: "I got a lot of discouragement from the teachers at the Mission School. They were all males from America and their wives were at home. There was some kind of taboo that a woman must behave like a lady, but the Principal was very encouraging - he said to keep it up when I came top of the class.

"I did start to go into nursing after my 'O' levels but the lecturer* told me I should not be there as I was far above all the nurses there in my understanding of the biochemistry she taught. She has been an inspiration to me since for I found when I returned from England that she is now a medical Doctor!

"By this time I was engaged to my husband who had gone to study in Canada, but he kept writing to encourage me and when he moved to England I joined him, completed my 'A' levels and did my BSc degree at Cambridge. I was so happy because even there I 'beat' quite a few boys!

"My husband had finished his PhD and our first daughter had arrived, but he still encouraged me, so I applied to the University of East Anglia where there was this course in the metallurgy of Rhodium. I was the only girl in the class of about 15 post-graduates and they teased me but my thesis came top of theirs. They were enjoying themselves when I was busy doing all my experiments!"

In the work she does for Air Zimbabwe Siphiwe supervises the heat treatment, welding, process and cleaning sections. The workers are all men. She says they were a little resistant

at first - she replaced an 81 year old man who had worked there for 20 years - but now relationships were excellent - no problems.

"Oh, I just enjoy my work," she says, "when I have an aircraft standing there and people say it's got to be done quickly but how can we do it, I just stand up and say 1,2,3 and the aircraft is up there. I usually stand in my garden and listen to it going nicely and I am happy!"

In their leisure times she and her husband read, jog, play tennis or go into the country with the children to watch animals. She says:

"When I am at home I am my husband's wife and the process and test engineer remains at Air Zimbabwe. It is the same for him - when he gets home he is my husband and Dr so and so, the plant pathologist, stays at the University."

During the day one child is at school and the other is with a maid at home. Siphiwe says:

"The time that I have for my children is quality time - while I was working at the university I had my first child and I realized that it was quality not quantity that counted because of the way my daughter is performing now at school.

"I will just give a quick routine of what I do. I get home at 5 o'clock - the first thing is to get my daughters into the bath and we are all giggling and laughing. Then we sit down to a meal and after that it's homework time. I don't give my husband any time until the children are asleep, then we talk, but sometimes he seizes the opportunity to help with the bathing and giggling and what not! I think that's because we've lived outside the country for so long where there was no nanny and he saw that
he was there to help."

Siphiwe says all her daughters are to take up science - if they want to do something else she will discreetly and diplomaticaly discourage it!

* (This was Dr. Taderera whose story is also told in these profiles)

FARM MANAGEMENT SPECIALIST

Christine Valaphi, Zimbabwe

Ms Valaphi went to Rumania to study for an M.Sc in Agriculture Economics at Babish Bolai University.

She grew up in Matabeleland where her father was an accountant but also interested in science. He encouraged Christine and her younger brother to continue in school. At first she wanted to do physiotherapy but then, because she lived in a rural area, she became interested in agriculture. For her A'levels she chose mathematics, economics and geography.

When she returned from Rumania she had no difficulty getting a job - she was offered two and chose to go to 'Agritechs' - the Agricultural Technical and Extension Services in the Ministry of Agriculture. She believes that promotion in this Government department depends on qualifications and ability.

She has two young sons who are looked after by a maid during the day. When she comes home her sons want to play - they do not understand she has to cook a meal!

She would advise girls to go for the sciences but if they get married they will face these problems, too!

PLANNING SPECIALIST

Ms Muramba has a degree in Agriculture Economics from the University of Zimbabwe. Since 1986 she has worked for the Agricultural Technical and Extension Services in the Ministry of Agriculture.

The work she does involves planning land use.

Rundai Muramba, Zimbabwe

"When an area of land is identified," she says, "we are called in to assess it, then we recommend the best crops and the best way of using the land on a sustained basis.

"We assess the soil, assess the irrigability then identify the arable portions and end up recommending the best crop for the particular farm, or the caring capacity if it is a livestock farm. And you look at how you can improve that farm and probably the number of people who can be kept on it.

"When you are working in the field the conditions may not be ideal but you find something and you get used to it.

"In my Department promotion is on a competence basis. If one is competent one is picked out so I think the promotional prospects are good.

"I would encourage young girls to choose science subjects because there is more to science than in most other subjects, because you end up teaching and the like, but with science you go in the field of research in most cases, which is very good. You keep on learning every day because the environment changes. Today we recommend this type of crop but tomorrow there is a drought and you have to shift to drought resistant crops and so on. You are kept up to date somehow."

She thinks a girl choosing to develop a career would be wise to choose a husband who works in the same field as she does so that he will understand and accept the demands of her work.

QUALITY CONTROL SUPERVISOR

Annie Shouhayi, Zimbabwe

Ms Shouhayi works for National Breweries Limited, Harare. She has a BSc degree in Bacteriology and Virology from the University of Manchester, England. Before coming to NatBrew she had worked in public health and veterinary research laboratories.

"I have always love of science," she says, "In my third year at high school we were divided into science and arts - I went into science as one of only six girls. In the A' level classes I was the only girl in physics, there were two of us in further maths, 6 in chemistry while the biology class was about half girls. Other girls were not very encouraging. They would tease us in the dormitories, saying 'how could you!'

"I suppose we are brought up to think boys can do more difficult things and that goes on into schools. Physics and maths are thought to be more difficult than biology or arts, so that if you try to do them you'll be questioned whether you really think you can do them. But if you stand your ground you can."

Annie grew up with 4 brothers and 3 sisters. Her mother was a teacher but when the father died she went into running the business that he left. Annie was six at the time and says:

"I saw her holding two roles - the father role and the mother role - so that opened the way. It doesn't matter whether you are a man or a woman you can do anything.

"My mother's sisters were very encouraging. They were always saying - 'Go on, you can do it, we didn't do it because in our times we had to get a job to help the family. My sisters mostly went into science and my brothers into finance, becoming accountants or auditors.

"My mother left it to me to choose a university course. I was away in England and she wrote 'Whatever you do is alright with me. I won't choose a cross for you, it's you who has to make the choice.' So I sat down with the prospectuses and had a tough time!

"I liked the look of the Bacteriology and Virology course which was only offered at Manchester. It has wide applications - you can be in a hospital situation, as I started, or you can be in an industrial situation as I am now and I have always aimed to be there. So I think I have made it!"

In her work at the brewery she supervises nine men most of whom had worked some years for the company.

"I adopted the theory," she explains, "that if I come in to be taught by them, to get to know what they know then I will form a good basis and build trust with them. But because I know a bit more than they do, I will be at an advantage. I have gone through all their sections and know what they do and it is working out. There are no problems.

"The work we do is largely analytical. When samples come in we test acidity, bitterness, colour and so on and actually provide the yeast and culture it. We test the water used in brewing - that's very important - and we have control of the boilers which provide steam for heating."

Within the structure of the company she expects promotion will be on merit and she has her sights on a General Manager's position.

Annie's husband, an electronics engineer, encouraged her to keep on applying for industrial jobs until she succeeded. At home he helps with meals and with their two young sons.

"You have to organize your time well," she says, "with children I think it's actually the quality of the time that you spend with them and not the quantity that matters. I try to give them all I can to compensate for the time I have been away and at weekends I spend a lot of time with them."

To young girls she says:

"Really, you should not be intimidated by anybody, even your classmates. The boys really can be a group of intimidators who are very strong and if you listen to them and are afraid of them you will choose something you may not enjoy. If you stand your ground you can choose what you want to do. If I have a daughter I will definitely encourage her to go into science and technology."

SURVEYOR

Mrs Adekoya has a First Class Honours Degree and a Masters degree in Surveying Engineering from the University of New Brunswick, Canada. She also holds a certificate of Data Processing from the International Training Centre in Aerial Surveys in Holland and a Nigerian Surveyor's Licence.

Olayinka Adekoya, Nigeria

She explains how she came to work in surveying: "I was one of four girls and two boys. My father was a teacher in one of the prestigious union grammar schools so we grew up in an academic environment. We were disciplined to work and took studying very seriously.

"When I took the Common Entrance Examination at the end of my primary schooling I was awarded one of the four 'State Scholarships' to the state grammar school for girls. When I finished Form 3 I chose the science side and went on to study pure and applied mathematics and physics in the Sixth Form. I passed well in all these and in the general paper at A level.

"Most of the girls doing science talked about going into medicine but a few of us were more daring and toyed with engineering. We talked about telecommunications, aeronautics and mechanical engineering but I never thought about surveying - no one knew anything about it!

"But while I was wondering how to spend the 9 months between finishing school and starting university I met a friend who suggested surveying, so I walked into Federal Surveys here in Lagos and spoke to the guy in charge. He was the Deputy Director and when he saw my certificate he said - 'Oh, my gosh - this is a brilliant girl! Do you want to read surveying?' ... I said, yes, why not! So that's how I came to do it. The Director then offered me an opportunity to study in Canada under the Canadian Technical Assistance scheme. I worked for Federal Surveys from January '65 to September and was then seconded for six years to do my BSc. and MSc. on full pay; the job was waiting for me when I came back. I am now the Assistant Director of the Federal Ministry of Works and Housing and the Principal of the Service School, Oyo Town, Oyo State."

Mrs Adekoya thinks being a woman may have helped in her career development, but it was not always easy. "If you are a woman among many men you are bound to be noticed and, if you are good, it makes it even better for you. But in my first year at college I was in a class of 500 - all male - and many of them taunted me because they expected me to drop out, but you know when Africans go to study overseas, they mean to take home the golden fleece, so the mere fact of them taunting me made me work all the harder.

"The most exciting thing about working out on the job in Lagos is even the taxi drivers parked to stop to talk to me and many of them went home to bring their daughters to talk to see me on the site. Even my bosses at work encouraged their female children to come round to talk with me. I still get that here in Oyo. A lot of people in the town have sent their daughters to chat with me to know that the sky is the limit for a woman and there should not be any barriers.."

Mrs Adekoya met and married her husband when they were students. They have 3 sons and one small daughter. She says:

"We are lucky in Nigeria to have the extended family. My mother helps to care for the children, we have house help and my husband shares the domestic chores. It is important that you have an understanding husband - African men are generally not very understanding, but my husband and I grew up together, he knew what was involved and I think this was the very foundation of our marriage in the first instance. We are very good friends. In Nigeria we believe in the home and for a woman to be successful and to be respected she must combine a good family life with a successful profession. I have been able to do that. Things are not always balanced - sometimes they tilt to the family and sometimes to the job, but you try to use your spare time to make up your losses.

"Just now I work in Oyo and my family lives in Lagos and so I am not able to perform my duties as I should, but I go to work from Monday to Friday and I spend weekends at home with my family and try do all my domestic chores, including cooking for the freezer, wifely duties, motherly duties, social activities and during the week I am totally committed to the job."

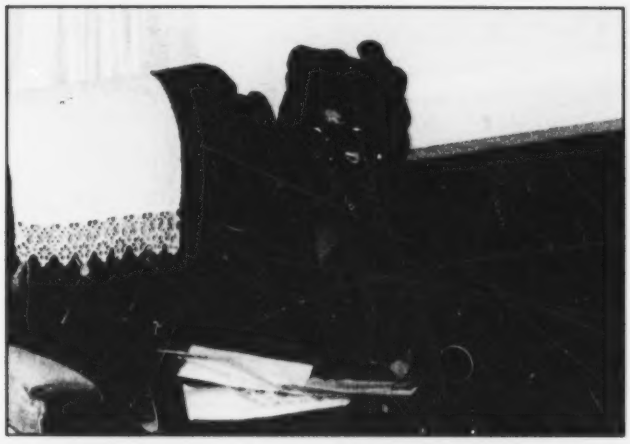
Mrs Adekoya is also involved in International Organizations attending the Commonwealth Surveyors' Conference every four years in Cambridge. She has participated in the International Federation of Surveyors and the International Society for Photogrametory and Remote Sensing. The scientific subjects of the latter are divided into seven technical commissions and in 1984, at the fifteenth congress in Brazil, Nigeria was elected as the first Third World

country, to host one of the technical commissions. Mrs Adeyoka was elected the Commission President - the first woman in the Society's history to hold such a post.

When asked if she would encourage young girls in Nigeria to take up science and engineering as a career, she says, emphatically: "I have no doubt in my mind, the answer is YES. I have had the opportunity to give career talks as a guest speaker in many secondary schools and I have always prided myself as a model. I tell the girls this is my life - you can have such a life if you accept the challenge.

"It is my belief that it is only when we take up this challenge and encourage as many women as possible to study the sciences and get into technologically-based professions that Nigeria's potential can be fully developed. We have to mobilize all our resources for the development of our country and not discriminate between male and female children. We should try to develop the potential in all of them."

ORTHODONTIST



Dr Semi Johnson, Nigeria

Dr Johnson trained at King's College, Durham, Dental School, UK. and is now the chief consultant in Dental Surgery with the Federal Ministry of Health. She is also the Chairperson of the National Committee on Women and Development which advises the Federal Government on Women's Affairs. She explains how she came to specialize in orthodontics:

"I first thought I would study medicine but when I applied through the colonial office (this was before Independence) I was told to wait a year. But then one of my brothers who was studying in London told me there was a vacancy in dentistry - 'You know we don't have a female dental surgeon at all in Nigeria' he said 'why don't you study this subject - you will be the first person?' So I thought, right, I used to suffer with toothache as a child, because I loved sweets, let me go and learn how to be a very good dental surgeon that will not cause too much pain to little girls!"

In her course there were five women out of 75 but she was the only one from Africa. She went on to specialize in orthodontics, practised for a year in Fleet Street in London and then returned to Nigeria to work for the Federal Government.

Most people she says, were glad to be treated by any dental surgeon as they were in short supply at the time, but:

"I remember one old chief who was astonished to see a woman in the hospital, surrounded by syringes, implements and bright lights. 'Why do you study a man's profession?' he asked, and looking at my very small wrists, 'how can you manage to extract teeth?'

"I told him I was taught by very, very good professors to manipulate and get the tooth out with minimum problems. He was quite safe with me and went off happy once I had extracted his teeth."

Dr Johnson comes from a professional family. Her father was a lawyer, her mother one of the first women who studied

nursing and maternal health and one of her grand uncles was Herbert Macaulay, the first Nigerian engineer, whose face you see on the Naira note. She has a brother and a sister who are lawyers and a cousin who is in medicine.

"I was one of the first people to be concerned about the education of girls," she says "there was like a small revolution in 1975, the International Year of Women. After the Mexico Conference all member countries of the UN had to work at the progress women were making in their countries. Nigeria, as a UN member, stopped in its tracks to look at where women were in professions and education and at their input into development; I was happy to be part of the change.

"We had to worry about how many girls were at school, what type of subjects they were learning, and how many eventually graduated into this type of science and technology professions that we are talking about. We are happy to say that this Government and the last administration listened to us. Women, too, recognized the part they could play. Now we have women in electronics and many other professions that used to be men's lines. We have come a long way forward and it is a happy thing.

"At the beginning it was quite difficult to get girls in some areas into school because of cultural norms and expectations, but now some of us are getting the feeling that market women and others believe it is a very good thing to educate their daughters, for they can help them in their businesses, teach them to write, deal with banks and so on.

"Some states even have legislation against parents that keep their girl children at home - they say that schooling is free and you have to send your female children or else --! Every arrangement is made also for nomad children, with specially trained teachers to teach them under the trees.

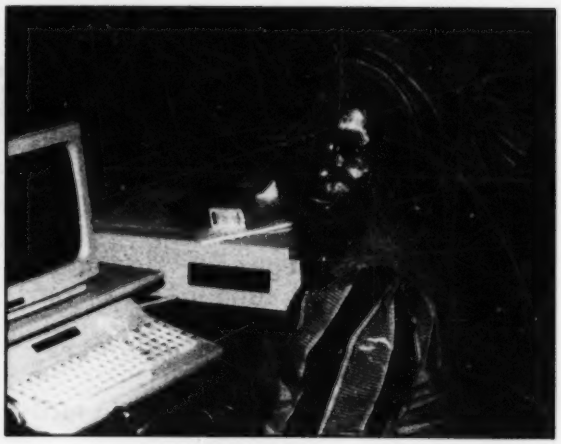
"We are planning to introduce science and technology at all levels of our 6-3-3-4 educational system so that all children, including females, can develop their potential. It is important to teach these subjects and mathematics in a way that interests children. And teachers must understand their subjects so that they can impart it like bread and butter!"

Dr. Johnson would encourage girls to go into science and technology, especially if, like her, they enjoy 'playing with gadgets.'

"In dentistry we learned to solder and to work with precious metals, melting gold for inlays and to make bridges and there's the skill of wiring up a fractured jaw; orthodontics involves both medicine and technology.

"But if you are a professional person you have to be a good manager. You have to manage your home first of all, because this is where you return, having gone out to work, you come back to your husband and children. When my babies were small, and I was breast feeding them, I would take them in the carry cot to the clinic to be with me. Then my husband and I took it in turns to be home with the children. It is something a career person has to work hard at."

ELECTRICAL ENGINEERS



Mrs Taiwo Ade Ife **Mrs Kehinde Olayinka Ogunsola**

Nigeria

Mrs Adeife and Mrs Ogunsola are identical twins whose lives have been very similar. They are therefore presented together. They both have a B.Sc in Electrical Engineering from the University of Bradford, UK. They each have an an M.Sc degree in Electrical Engineering and a Diploma in Micro Wave Physics. They are members of the Institute of Electrical and Electronic Engineers and of the Electronics and Radio Engineers,.

Mrs Adeife is the Principal of the Federal Technical College at Yaba in Lagos, Nigeria while her sister, who also taught for a time, has her own computer business, Mrs Adeife says:

"We have been a pair of inseparable identical twins. We have always done things together and we have always thought alike.

"We both attended Kings College in Yaba Road and were both very good at the sciences, especially maths and physics. Our father was a scientist and our parents would have loved us to do medicine but maths was our preference." Mrs Ogunsola adds:

"We wanted to do Pure Mathematics degrees, but we had scholarships from the Federal Government and they wanted engineers. We got a lot of encouragement from our professors at the university. Actually we were the very first set of female engineers from Nigeria and I remember, when we were in England, we had a series of interviews done on us and during the first year we had a lot of encouragement."

They returned to Nigeria after gaining their first degree and wanted to go into military service, but there were problems at the time in commissioning women in the Engineers Section and so they were sent to the Ministry of Education to become teachers. Mrs Ogunsola taught at Ibadan Grammar School and both lectured at Federal Technical College, Yaba, where Mrs Adeife is now Principal.

Mrs Ogunsola says:

"We left Nigeria again at the same time to do our Masters degrees. I went to Birmingham in England, but my sister chose, this time, to go to the USA. When I came back in 1973 I went into industry; I was the head of the technical section of an engineering firm in Ibadan where I had to supervise the maintenance and repairs of different kinds of electronic equipment."

Mrs Ade Ife regrets not being able to obtain any direct industrial experience, but says:

"Even in the classroom I have always put myself into the practical courses; I have always endeavoured to see the practical aspects of the course and now I think I match up any man in the field.

"I have always been enterprising and have always liked to explore. At the university the lecturer in welding, joking said, we shouldn't, as women, exalt ourselves, but let the boys help us. I didn't accept that - I wanted to do things for myself."

Her sister says:

"I think there are a lot of challenges in being a woman engineer - these are the kind of things I personally like. I like to see the reward of what I am doing and in engineering this is possible."

Both sisters married before completing their first degree. One says:

"Our husbands are also in the sciences so they have been able to accommodate to our thinking. Our husbands have been an inspiration, supporting us and making us think the career is worthwhile."

And the other:

"My husband is also an engineer and a scientist like me. He has given me a lot of encouragement, in fact I did my Masters degree after I got married and he has always encouraged me to reach the top in my profession."

Mrs Adeife has three children: Her elder daughter is a qualified doctor, her son is studying to become a civil

engineer and the younger daughter, still at school, is very good at maths and physics. She says:

"I want to encourage her to be an electrical engineer, to keep the flag flying, but I think she wants to be a teacher like mummy!"

Mrs Ogunsola has five children:

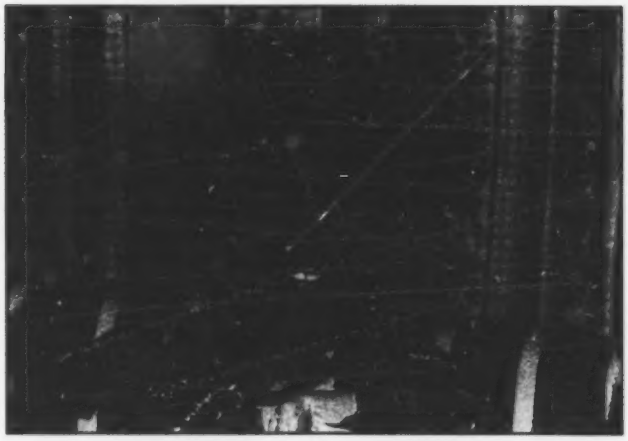
"My eldest daughter, my first child, is at the University of Lagos doing Electronic Engineering, I hope she will go on to do Computer Science so she can take over the business when I retire. The eldest boy is also at the University of Lagos, studying Civil Engineering like his father. My husband has a consultancy company and we hope our son will be able to take over his business when he graduates. The other three are still at secondary school. People laugh and say we are an engineering family!

"I think engineering is a beautiful profession. The Association of Nigerian Women Engineers are doing a lot to encourage girls to go into engineering. We don't see it as a preserve of men. In fact we find that women engineers are better than our male counterparts. They are often more dedicated taking more time to look at things critically. The more women we have in the field, the better for the advancement of the country."

Mrs Adeife points out that there are still too few girls in technical colleges such as her own.

"This is because of the bias in society and the generally poor teaching in maths and physics. There is a general fear in girls that maths and physics are impossible subjects but one has to make them realise that these subjects are very much part of our everyday life. This can be done through teaching - I have said many, many times that if teachers are more practical, and make these subjects come alive, girls will find they are not impossible and will be more motivated."

ARCHITECT



Mrs A Lily Henry Adekola, Nigeria

Mrs Adekola obtained a Bachelor's degree in Architecture from the Ahmadu Bello University in Kaduna State, Northern Nigeria. She is a member of the Nigerian Institute of Architects and the Royal Institute of British Architects.

While she was at school Mrs Adekola wanted to be a librarian but during the months between school and higher education she went to work for the Federal Ministry of Surveys and learned about architecture and its relation to fine Art.

She says: "My family background has a little to do with it. My mother is a dressmaker, so from an early age I have been familiar with designs - dressmaking is a form of design and art work. I used to design patterns for my mother to sew for her customers, so I have always been interested in anything to do with designs."

At university there were two women in her year and only 5 altogether in the five-year course.

"Initially our fellow-students welcomed us; they thought we added colour to the class, but they didn't take us seriously. Later they found we were a force to be reckoned with as we began to pull away competitively. Finally they respected us and accepted us as 'one of them'.

"The lecturers at the time were mostly expatriates and were probably used to women studying architecture. They were prepared to encourage us, particularly if we had ability and could pull our weight in class."

After she qualified, Mrs Adekola went into private practice.

"Later, I went down to Lagos with my husband, joined another firm of consultants and, after two years, took my professional exams. I stayed with that firm for four years and then joined a design group as a team architect, in charge of projects and supervising younger architects. I became an Associate Partner in the practice and was offered a partnership. But, by then (1974) I had decided to set up

my own practice. This I called ENAC consultants, as it was a combination of engineering and architecture.

"My husband is a Civil Engineer and was a Professor at the University. In the early 1980s he became Vice Chancellor of the newly-formed Bauchi Further University of Technology. I had to decide whether to go with him to Bauchi or stay in Lagos with my practice. I tried to persuade the staff to follow me to Bauchi, but they refused. I went to Bauchi to assess whether it would be possible to set up a practice but they seemed more conservative there and I couldn't speak the language, so I thought I wouldn't make a very good impression. I came back to Lagos and for about a year we kept two homes and one day I woke up and said - what is this? I decided to put my practice to sleep and join my husband!

"Fortunately the university had just advertised for a Deputy Director of Physical Planning - I applied and got the job. This opened up a further aspect of architecture for me and they were glad to get an architect of my experience. I help them with contract management and supervision of construction. It's a young university and its development needs supervision to meet planning deadlines."

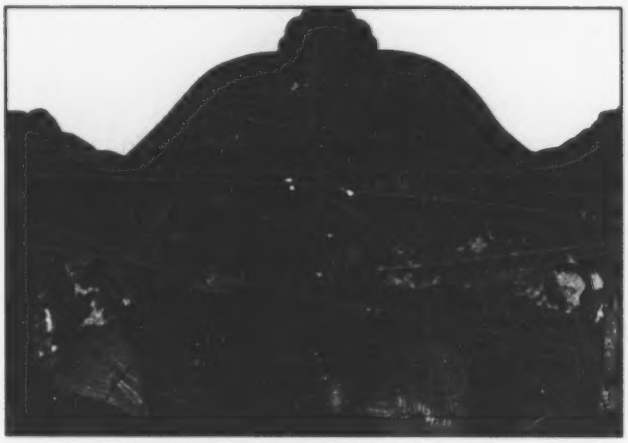
Mrs Adekola and her husband have three children. The eldest, a daughter, is a Civil Engineer, one son obtained an Economics degree and the other is studying architecture.

"You see, my husband and I took turns! Our daughter followed him and our son has taken to my field. My husband was an important influence on the children. He worked hard on maths with them. Of course, if you you're good at maths you're good at science also.

"I would encourage girls to become good at maths in the primary school and then to choose science and technology. I have enjoyed my work and given the opportunity, I would do it all again!"

DENTAL THERAPIST

Mrs Nwokedi is a dental instructor at the Federal School of Dental Technology and Hygiene where she trains dental therapists; she is also in charge of a newley-opened clinic. She explains how she came to choose this career and what the work entails.



Mrs Kofo Nwokedi, Nigeria

"I come from a science family; my grandfather was the first Nigerian doctor - Dr. Sapara. My father was a pharmacist and my mother, a nurse.

"I chose science subjects at school and was very interested in Biology. First of all I wanted to do medicine, but there were only a few places at the university at the time and I would have had to go to America to study. I was very young and didn't want to leave my parents, so I was wondering what to do when we had a career's week at school. I was really taken by the account of dental therapy.

"Soon after I had toothache and had to visit a dentist; I was highly impressed by the skill and said - well, maybe I'll take this profession. I happened to meet the Principal who said I was very good material and that it was a very new profession in Nigeria and I would be one of the first to train. I joined the Federal School of Dental Technology and Hygiene and followed a three year course and a year of practical.

"A dental therapist assists the surgeon to care for the cleanliness of the mouth and teeth. We scale and polish the teeth and care for the gums, treating them to keep them healthy. To enter the course you have to have school certificate, with science subjects, and you learn more science - anatomy, physiology and a little chemistry - on the course."

Kofo and her husband have three children - a daughter and two sons. She sees no conflict between a career and family commitments, saying:

"I believe that if one plans ones family there is time for everybody and everything gets done! Before I leave for the office I see that everything is ready for the family and

that there is food for them. When I return I relax and enjoy supper with the children.

"My daughter is really science inclined now and is looking to be a dentist. I am very, very happy about this and look forward to when she will qualify and then we will have our own practice. The little boy is science inclined, too, but the middle one is more interested in arts like his father."

Mrs Nokedi thinks that young people have better chances to study science now and urges them to do so. She emphasizes that there are many opportunities in the dental profession.

"If you're not interested in therapy, then there's dental technology as well as surgery. The pay is good - I am on a very good salary. I have some classmates who are not married and they look after themselves and even help support relations on their salary. And you're working with people all the time - you may be lucky to meet your future partner through your career. A lot of patients are interested in girl students - we have to make sure they finish their training!"

AGRICULTURALIST

Dr Yejile Kehinde Osikanlu, Nigeria

Dr Osikando has a B.Sc degree in Agriculture from the University of Lagos, a Masters degree from the University of Wales and a Ph.D from Manchester University; the higher degrees are in Plant Pathology. She is a Senior Research Fellow with the Institute of Research and Training which is part of the Obafemi Awolowo University, where she is also Assistant Director in charge of Services.

As a little girl Yejile was very good at school, always coming top of her class and her parents were keen for her to become a doctor.

"I went to St Anne's School, Ibadan, which was one of the best girls' secondary schools then, but we could only do General Science. I was very good at arts subjects - when I was in Form 2 I wrote a poem which I have framed in my room - but I was intrigued by science and wanted to know more.

"I realised I could not enter university for medicine with only a General Science qualification, so my father suggested I should go to Lagos to see the late Professor Awokoya who taught at the Federal Emergency Science School in Lagos and who was a classmate of my father. I spent a year studying 'O' level physics, chemistry and biology. There were problems again at 'A' level as my school had no physics or zoology teacher and then I found I had to do some chemistry and pass a General English paper to enter for medicine.

"At this point I met Professor Oyununga, who suggested I was wasting time trying to get into medicine. 'Look', he said, 'there is no woman in Agriculture. You come and do Agriculture and be the first lady!' I felt the challenge and took it up!

"In the University I was the only girl in the class and, of course, all the boys teased me. They tried to create difficulties for me, but I did very well in the exams. They were surprised and didn't know how I managed it. At the end we had a tractor-driving test; I came first and was named the Tractor-Driver of the Year. After that they had no choice but to accept me.

"I went to work for the then Western Region Ministry of Agriculture and Natural Resources. From here I could do further studies. I wanted to become a doctor, even if I couldn't do medicine. So I went to Wales, to Aberystwyth, to do Plant Pathology. After my Masters I found out that I couldn't do a PhD in this subject at Aberystwyth and had to transfer to Manchester and take an extra year.

"I returned to my job, which had changed while I was away. The Ministry had become part of the then University of Ife and I became a research fellow.

"I have been here ever since, doing research and publishing papers. I have moved from Research Fellow 2 to Research Fellow 1, Senior Research Fellow, Head of Programme and now Assistant Director. I should very soon, by the Grace of God, become Associate Professor and then Research Professor."

But things have not always been easy for Dr. Osikando. Some male colleagues have objected to going out into the field with her. She describes how in her first research project, her co-worker made frequent disparaging remarks but in the end, had to accept her superiority as the professor, preferring her style of reporting, asked her to write up the whole project.

A few of her women friends have not understood her interest in her career and say - 'why do you worry yourself, you should just go and get married and have children.'

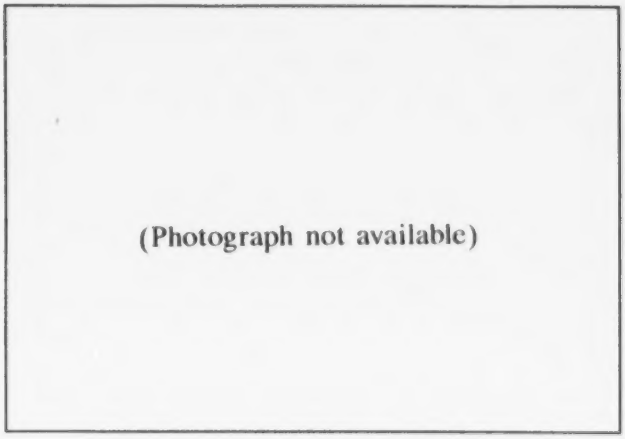
"Fortunately," she says, "I have such an understanding husband. He is a scientist, himself, and is one of those rare men who takes a pride in having a wife who is in science, an agriculturalist, and who is doing something very unusual.

"He has encouraged me to do extra things, popularizing science and participating in activities of the Science Association of Nigeria. I have just concluded two years as President of the Science Association - the first woman in this position.

"The Association is making big efforts to encourage girls to do science, as is the Nigerian Association of Women in Science, Technology and Mathematics. I think science subjects should be compulsory in secondary school and science teachers should be helped to make it more exciting for their pupils."

MATHEMATICS EDUCATOR

Professor Osibodu was Professor of Mathematics Education at Obafemi Awolowo University (formally University of Ife). Her degrees were a B.Sc in Mathematics from Washington DC, a Masters in Mathematics Education from the University of Illinois and a Ph.D in Education from Michigan State University, all in the USA.



Professor Bukunola Osibodu, Nigeria

Sadly Professor Osibodu died early in 1989, soon after she was interviewed for this project.Her contribution to mathematics education and to the cause of women and science, technology and mathematics will be keenly felt both in Nigeria and internationally.

Professor Osibodu traced her interest back to her schooling and to her family background.

"I went to a co-educational school where science subjects were taught, unlike in some all-girls schools at that time. I had some good science teachers who aroused my interest. And, particularly, in mathematics I was taught by a brand new graduate teacher from the University of Ibadan, who had studied maths and physics. He was so enthusiastic and radiated mathematics and physics to all of us. From Form 3 to final exams in the sixth year I was taught by him and his colleagues. He is still alive - Mr J.Adei Obunaike - he was one of the first people to send me a congratulatory card when I became a professor.

"But there is an element of home background also. My mother was a very good trader who did a lot of buying and selling in the market in Kano. She traded between the north and south of Nigeria and we all went to market with her. She would call us to work out 'twenty baskets of onions - how much is that if one basket costs a shilling and six pence? (as it then was). While we were looking for a pencil she had the answer! My father was also in trading so we were used, as a family, to dealing with numbers and quantities, adding, multiplying and dividing, so this came easily for us.

Although 'Buky' remembered that her teachers at school were *always supportive, the same was not true of her school* 'mates'. "There was this silent but subtle antagonism - that that little girl got out some of the problems, or all the problems, that we didn't get. They teased one all over the place or were curious, sometimes sneering, saying 'Oh, book worm, she's always doing maths' or 'why don't you try something else, eh, that's more for the boys!' And I must say that even in the American University there was the teacher who thought it odd for a woman to be persistent, to want to solve all the problems before the next class and to turn up for every tutorial!"

"Professor Osibodu had four children - the older two had graduated, the daughter in food science and technology and the son in agriculture. The younger two were with her and at school in Ife. In spite of being a single parent she travelled widely in Nigeria, running courses for mathematics teaching, serving as President of the Mathematics Association of Nigeria and conducting research into the problems faced by girls in mathematics. She spoke about some of these.

"I remember some secondary school teachers of mathematics saying 'But, you see, the girls don't understand' or 'the boys get it faster than the girls' And when you observe them teaching you find they ask the boys all the questions and ignore the girls - no wonder the boys understand faster.

"I find, too, that girls have the same idea - they accept that boys can do mathematics better than girls. I have done studies with first year pupils just coming into secondary school and find that someone, somewhere, at home or in school, has put into the heads of these little girls 'Never mind, the boys will do better than you, anyway.' It's very sad.

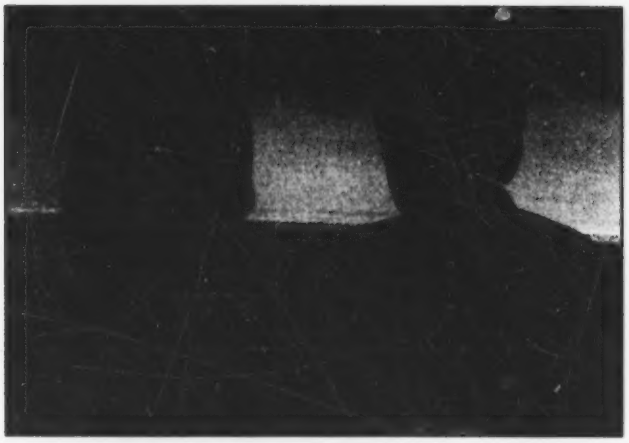
"But I noticed one interesting thing that raised questions about my research but also about how girls respond to expectations. I was asking about attitudes to mathematics, and in the first school they didn't know who I was - just a teacher who wanted a questionnaire completed. In the second school I was introduced as a professor of mathematics education. The girls in the second school were much more positive in their response to mathematics. My research was grossly affected but it was an interesting observation for me to note that when the girls have somebody to relate to, who has actually done mathematics, they are very willing to say, yes, I am interested in mathematics and like to do this or that activity.

"My message for girls is that the sky is the limit for us women too in the sciences. Girls can do as well, or better,

than boys if they put their minds to it - I would say the secret is *nothing but hard work!*"

BIOLOGIST

Dr Okeke is a Senior Lecturer in Biology Education and Coordinator of Science Education in the faculty of Education in the University of Nigeria, Nsukka. She has a B.Sc in Biology and Education from the University of Nigeria and a Masters from the University of Leeds, UK.



Dr Eunice Okeke, Nigeria

She was born an Igbo in Eastern Nigeria and grew up as the fourth child in a family of six. "My parents had a very great faith in education even though they didn't have much western style education themselves. My father said anyone could reach any height as long as they tried. By doing a little farming, a little trading, they supported every member of the family who showed enthusiasm to go to school. All my elder brothers and sisters went to secondary school and university. My parents made tremendous sacrifices - I remember my mother didn't have clothes to wear because the most important thing was to get the school fees ready at the beginning of every term for all the children.

"When we were in secondary school we didn't have much opportunity to do science, but when we entered the university this was recognized and a special course was put on. I took this course and became interested in science."

Eunice gained entry to the Women's Training College at Umuahia with a scholarship to study English but she wanted to change to science. As her husband put it, she nearly fell out with the Principal of that institution who gave the option to do English or lose the scholarship. But she stuck to her guns and the Dean of Education, Professor Baosofowa, came to her rescue by writing to the Board of Governors, pointing out the very good scores she had obtained in the Science Course. So she switched from English to Biology and became a scientist.

She remembers: "There were fewer girls than boys and during zoology lessons - particularly during dissection or identification of mammalian organs - the boys would tease and try to embarrass us. But this made us more determined and we went out of our way to show things to them first. We found that sooner or later they left us alone!"

She and her husband became betrothed at teacher training college and went on to the university together. It was he who later saw an advertisement for a fellowship at the University in Nsukka.

Eunice was pregnant at the time, but he brought her to the interview. When they arrived they found something was missing from her papers, so he rushed home to Enugu to fetch it and the interview was successful. When he went to study in Leeds he battled to get permission for her to join him there to do her Masters and Ph.D instead of in Michigan, where the University wanted to send her.

She says: "A career at times does conflict with family commitments, no doubt about that. There have been a number of times when I have had to leave the family to take on professional duties but we have had relations or paid help to support the family. But most of all I have had the support and encouragement of my husband who, at very short notice, changes his own plans to take care of the family while I am away. This has helped me to resolve the conflicts of family and career duties. I have been very fortunate - it is only in a few cases that you find a husband trying to assist and recognizing that his wife has to achieve, too, and utillize her talent fully.

"My parents, too, are very proud of what I have achieved. My father says 'She's almost a man, she has nothing different in the way she thinks and does things from my sons.' They would wish that many more women would attain as much."

The Okeke's have four sons - three are in science and one in law. None has followed their father who is Head of the Fine Arts Department at the University. Dr Okeke recognises that it is easier for boys than for girls to go on to study the sciences. Her work is mostly involved in teacher education. She says:

"We need to develop our primary science and make sure that parents and teachers recognise that science is for all, for poor and for rich, for female and for male.

"In the last ten years we have tried to include topics that will sensitize secondary school teachers to the need to encourage the girls to take science much more seriously than they do. We try to get teachers to understand the subtle ways in which they have been discouraging girls. We also discuss strategies they can use to change the attitude of girls to be more positive to science.

"Girls who do science have no difficulty getting employment in Nigeria. I have been talking with some young engineers - the Ministries are encouraging them and industries are taking them on."

BOTANIST

Professor Agnes Uduebo, Nigeria

Professor Uduebo now holds the position of Commissioner for Education for Bendel State. She studied for her degrees in Botany in Nigeria: the B.Sc in the University of Ife, the M.Sc in Ibadan and the doctorate at the University of Lagos.

She married after her first degree and taught for a year in a secondary school before returning to the university for the masters programme. Following this she was appointed as Assistant Lecturer in the University of Lagos and remained in the university system. In 1982 she returned to her home state of Bendel to assist with the development of the young state university at Benin. From there she became Commissioner, first for Health and then for Education.

Agnes grew up in a purely rural farming community, she says: "All my life I have had cause to handle plants at various stages, either in the growing of them or in the processing of them. I suppose this influenced my choice of Botany.

"Although we were very isolated, some of my family had travelled and this influenced me. For example, my father was out of the village quite early. He had, as a boy, worked for an expatriate couple in Lagos. The man was a naval engineer and his wife, 'the Madame', took an interest in my father and taught him to read and write. He speaks very highly of her; she was very influential in the home and I think this influenced his attitude to the education of girls. He was also in Burma and other places during the second world war and saw women there contributing to the development of their country.

"When he came back it was time for me to go to school. The secondary school was three days journey away, so I was a boarder. To get there we would leave my town, get to Benin and sleep. The second day we would travel as far as we could and then sleep in the bush and continue the third day. The road was not what it is now. Not many parents would have encouraged this but my father saw it as a necessary development of the individual. Then, of course, I was the fourth child - my eldest brother had studied medicine, so this encouraged me also."

Professor Uduebo has an interest in medicinal plants and while she was in the Ministry of Health she set up a committee to study the relationship between traditional remedies and orthodox medicine. "In that committee I had a pharmacist, who could advise on the medicinal aspect, I had a botanist to help with the identification of herbs and then had traditional healers working with them. We were trying to modernize traditional healing," she says.

She finds relating to nature a very healing process. "In my village, near our house, there is a mango tree that is older than I am and year in year out it continues to flower and bear fruit without any strain. So I ask myself what is all the hustle and bustle about? In the free time I have - and I definitely try to make free time (all work and no play is not good for the system) - I go for a long walk, admiring nature and getting my system relaxed. In addition to that I do a little farming, or gardening you might call it."

She finds people have a great admiration for women who have reached responsible positions.

"But there are some older ones who see you as out of place - you are sort of intruding. And if a woman is very efficient, then society and even the husband, can leave so many things to her that life is hard! Society has to change its values.

"A woman has to make some sacrifices in her career if she has a family. For example, early on I was entitled to one year sabbatical to go away to study every seven years, but I couldn't because of my young family. It wasn't that somebody said I shouldn't, but I didn't even apply because of a sense of responsibility to my family. Then you fall behind in publications and your career slows down. But I would do it all over again!"

Her advice to girls is:

"I would advise them that they should learn to have confidence in themselves. I am a bit worried about this - it looks as if a lot of our girls are losing confidence in their ability to perform, especially in the areas of science and technology. I want to say that there is basically no difference between the brain of the male and the female, physiologically or anatomically. I think it is just the influence of society, including ourselves, the women. My advice to the girls is firstly they should not be discouraged by comments from those around them and secondly they should be committed to their studies.

"They should realize that there is a time for everything - they should work while they work and play while they play. There is time for studies, time for fashion, time for pleasure. While they are at school they should be fully committed to their studies."

MATHEMATICIAN

Professor Grace Alele Williams, Nigeria

Professor Williams read for a Mathematics degree at the University of Ibadan when the degrees there were validated by the University of London. Her Masters in Mathematics Education was obtained from the University of Vermont and her doctorate in Comparative Education and Mathematics from the University of Chicago - both in the USA. She has written many textbooks for the teaching of Mathematics. She is the Vice Chancellor of Benin University in Bendel State.

Grace Alele describes her childhood and how she came to study mathematics.

"I lost my father when I was very young but I had an educated mother. She had been a teacher, but in those days you couldn't marry and continue to teach. When my father died she became a trader. I am the youngest of the five children and that may have influenced me because one tried very hard when one was young to imitate the older boys. I think that encouragement was invaluable to my life.

"We lived in a small town - Warri - some one hundred kilometers from here. After elementary school I went to Queen's College, Lagos, as a boarder. This was then the only central government secondary school for girls.

"I was about the best girl in mathematics in my class - in fact, in the whole school - and everyone assumed I would do mathematics. I enjoyed working mathematics problems, so it seemed a natural expectation. You must remember at this time girls schools had little or no science and so mathematics was the one avenue open to us in the sciences.

"From school I went to University College, Ibadan, for five years and then went into teaching. By then the Richards Constitution was operating, which meant anything that was provided in the Centre had to be duplicated in the regions. The school I taught at was the Queen's College in the West Region at Ede.

"I applied straight after my degree to do a PGDE (Post Graduate Diploma in Education) but for three consecutive

years I was never on the selection list. My juniors (all men) were being posted to go and, you know, after you have your PGDE your status changes. You count your seniority from the year you get your PGDE.

"By the third year I was fed up and I had this opening in America so abandoned the PGDE and went for a Masters - especially one that involved me teaching mathematics in a university as well as learning more mathematics. Then I got a fellowship from the University of Chicago which enabled me to complete the coursework for my doctorate and while I was writing my thesis, to keep body and soul together, I taught in various small colleges around Chicago. You know, mathematics is quite a subject - you can always get a job with it!"

Professor Williams sees great changes have taken place as a whole in education and particularly for women.

"In 1949-50 there were 10 girls and 400 boys in university, now there are 136,000 and 20-25% are women. We have still some way to go, particularly in technology and science, but in other areas - the home industry and food science - which need a little science, mathematics and technology - more and more girls are carrying out work successfully. Because girls are more educated now they can communicate and relate to fashion and design with greater sophistication. I look forward to the time when I will walk into a sitting room in Nigeria and see that all the artefacts, all our internal decoration is 100% Nigerian made by Nigerian women."

When asked about people's reaction to her being Vice Chancellor of the University of Benin she commented: "I think there's been a careful watch to see what I am going to do; the women have been very happy about it. They want to ensure with all their might, if I may say so, that I don't fall flat on my face, because they want to show that given equal opportunities, women can do what men are generally doing. For the majority of men I think you can say they watch, but a few men have come rallying round saying 'this woman could be our sister, she could be our daughter, she could be our mother, let's see that she succeeds', and usually I have, apart from a bad press every now and then, very fine support from most people."

Professor Williams has five children. The eldest son is with his father in Lagos. The middle two are in Benin, the boy studying engineering and the girl medicine, while the youngest boy and girl are at King's and Queen's Colleges respectively. She knows the problems a young mother faces trying to carve out a career and to care for her children.

"You must have a very understanding husband to appreciate that you may not have as much free time as he might wish. I'd like to pitch my message to young women who are just leaving university and older women who are married and in science.

CHIEF EDUCATION OFFICER

Ms Agholor holds a B.Sc degree in Microbiology and a Masters degree in Botany from Howard University in Washington DC. She is at present the Chief Education Officer in the Federal Ministry of Education in charge of the Popularization of Science and Technology programme.

Ms Rosie Kitchi Agholor, Nigeria

Ms Agholor explains how she came to work in the sciences: "While I was in school I was good in all the subjects, but I found the sciences more exciting, maybe because I don't like reading too much! I will also say that my mother had an influence on me. She wanted me to read medicine and this means doing science.

"Both my mother and father like nature. When I was a child we always had pets - dog, parrots, rabbits, pigeons, turkeys, an aquarium - lots of animals - and plants, too. The house was full of plants because my daddy loved gardening. This gave me a good background for the life sciences.

"My father was a police officer, my mother trained to teach, but when she married my father thought she should stay home and take care of the children, so she became a professional designer and seamstress which she did at home and looked after us at the same time.

"My sister studied English, but two of my three brothers are in science - pharmacology and engineering - while the other is in business.

"I didn't want to go to university in Nigeria - I wanted to go to the US. But when I got there I found I had to do a first degree before going to medical school. I enrolled for zoology, but soon changed to microbiology which I found more interesting. I decided also that the medical training would take too long, so I settled for a Masters and, because there was no course in microbiology at that level, I did it in botany which I found just as interesting. My mother was happy as long as I stayed in the sciences!

"I don't think all this study got in the way of getting married. At college during my first degree I had lots of mates who were boys. Some of them teased me that I was too serious and that I didn't have time for dating and so on, but I told them I came here to study. I wasn't interested in getting married at that time - I just wanted to get my degree. When I had finished my masters I met the right man - my husband - and we got married.

"My husband has been very co-operative as far as my work is concerned because my present job is very demanding; I travel a lot, but he encourages me to go ahead and he helps care for the children while I am away from home.

"We have two children - the twelve year-old girl is in her second year at the Federal Government Girls College. She is very good at maths and likes science. I am trying to encourage her to choose this line. The boy enjoys general science but has yet to go to secondary school."

She thinks botany is a good subject for girls to study as it is so important in agriculture and for development.

"You can find out different species of plants that are better for our environment than others. We have done this with many crops such as palm trees, rubber, cassava, yams and so on. We have cross-bred and got better yields. I think women have a flair for agriculture and the propagation of food and most of our food is obtained from plants,"

Ms Agholor describes what her work for the Ministry entails:

"My primary assignment at the Ministry of Education is to popularize science and technology to everyone, especially at the grassroots - the primary and secondary schools for which the Federal Government is directly responsible.

"I started by organising the National Young Scientist Competition for all secondary schools in the Federation. But I found that the ratio of girls to boys among competitors was very low, so something had to be done. I attended a workshop in Bangladesh on Popularization of Science and Technology to Enhance Women's Participation and on my return proposed the formation of an association of women in science. I obtained support from the then Permanent Secretary and now the Director-General, and the Nigerian Association of Women in Science, Technology and Mathematics (NAWSTEM) was formed. The aim of the Association is to encourage girls to go into science and technology-related courses.

"I have also set up Junior Engineers, Technicians and Scientists Clubs in schools. Formally we had just science clubs, but science is not complete without technology, hence we decided to include technology and they have become JETS clubs. The children will not only learn science theory but

the applications and find out about the scientific and technological things around them. They will learn the fabrication of things and help maintain and repair equipment in the laboratory.

"We are working with women also, and cooperating with the Women's Education Unit. The Government of Nigeria, as well as the Federal Ministry of Education, are trying very hard to get women to go into technology.

"The Government is trying to equip every school for science and technology studies. The new 6-3-3-4 education system should help. Technology is being introduced and all the sciences are compulsory from junior secondary.

"I don't think there's any resistance. Girls have seen the advantage of science, they have seen that the country cannot progress without science and technology. Science and technology is the language of the day. Even those women in the rural areas who don't have a formal education are very conscious of science and technology and are encouraging their daughters to go into them. Perhaps I shall soon have more young girls entering for the Young Scientist Competition!"

Ms Agholor is assisted in her work of popularizing science and technology by Ms Lami Amodu who commented further on the Young Scientist Competition:

"The states organise their own states-level competition and select the best students to represent them at the national finals. We organise these in each state capital in turn. The finals are usually very interesting because the standard of the questions is very high and because attractive prizes and trophies are awarded. We are getting a great response from the students and are keeping a register after each competition to see what happens to the participants - do they continue in science or do they become discouraged somewhere along the line? Up to now most students have continued, going into medicine, engineering and many other science-related fields."

Ms Amodu is not a scientist; she has qualifications in English, History and Education. She explains how this came about:

"When I was at school I was good at all subjects. My father wanted me to do Law and Islamic Law in particular, but after school certificate I was confused. All the teachers tried to encourage me at the same time to do their courses. We didn't have enough science teachers - those we did have were not Nigerian - so I went by the personalities and I was more attracted to the arts teachers and did their subjects. I think the regret I have is that I lacked proper vocational guidance. I think I would have gone in for the sciences and done something like medicine or pharmacy."

But she has found the work of popularizing science and technology so interesting that she is planning to take a further course - a second master's degree - in some aspect of science or technology. "I'd then have a sense of achievement knowing that I still belong to science and technology," she says.

AUTO MECHANIC

Mrs Amakloe is an Auto Mechanic working with a big motor company in Accra. She trained at the Accra Technical Training Centre and has worked as a qualified mechanic for twelve years. After being an apprentice for four years, she worked as a grade two technician and now has six years experience at grade one.

Mrs Janet Amakloe, Ghana

She works on cars and trucks, overhauling engines, checking brakes, transmission, gear boxes, in fact generally servicing and repairing them.

Some men are afraid that, because she is a woman, the work will not be done properly, but she rarely gets complaints after the job is done. She thinks women make better mechanics because they are careful and take their time to do a good job, while men are always in a hurry to finish, which can cause mistakes!

Janet grew up with three brothers. The family had an average income from the father's work as a prison officer. She started school early and so gained the form four certificate of the West African Examinations Council by the time she was 16.

She says, "I wanted to be a pilot but my parents didn't have enough money to sponsor me on the course. I only chose auto mechanics because I couldn't pursue my first ambition. When I started, my parents were not happy about it - they saw it as a man's job - but I insisted and eventually they allowed me to take the course".

At the training centre one teacher was very supportive, encouraging her to take the training seriously when girl friends tried to persuade her to give up. When she had qualified she met some prejudice against women from employers, but finally got the job with SCOA Motors.

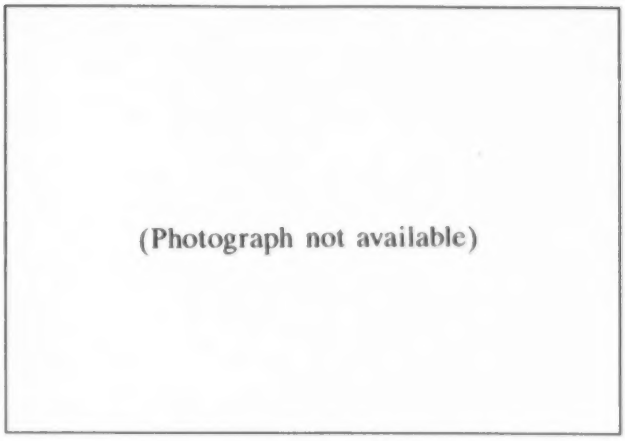
Janet finds no conflict between her work and her family life. In 1988 she is at home, on maternity leave, with a small baby. Her husband works as a transport contractor and is sometimes away from home for days at a time. She also has a five-year old daughter, who has just started nursery school, and a maid helps with the housework and care of the children. When the baby is about four months old she expects to go back to work part time for three months before resuming full working hours.

She receives full pay while on maternity leave but no housing or other allowances. She believes girls should go for auto mechanics: "there is nothing in it that a girl cannot do - what a man can do, girls can too."

Janet is the only woman working in the auto shop. Some of the men, she says, quarrel with her but "I regard them as I would my brothers and I don't normally take that kind of thing to heart."

She enjoys her work and is saving to buy a secondhand car to repair and use. She thinks a woman gets promotion, just like man, if she has the training and qualifications.

BROADCASTING ENGINEER



Mrs Sarah Boye, Ghana

Mrs Sarah Boye has an M.Sc in Electrical Engineering from the Soviet Union. If you are in Ghana and watch the news on television, Mrs Boye probably had a hand in getting it on the screen! She is one of a group of four engineers in the television division of Ghana Broadcasting Corporation (GBC). They maintain and repair the video and audio transmitting and recording equipment which is constantly being up-dated. Ten other engineers work in radio, one of these is a woman and has gone to Britain for further training.

Sarah was born in the Eastern region of Ghana where her mother was a kenkey seller while her father was away working in Accra. She did well at elementary school, passing the Common Entrance Examination to secondary school. Her father then assumed responsibility for her education at Mfantsiman girls school. Her 'O' level results there were good in both arts and science subjects. The school had just introduced science subjects and were anxious to build up the sixth form, so she and two other girls were persuaded to join 9 boys brought in from a neighbouring school which had no science facilities. She says;

"The other girls were scared to do science subjects, they think physics is too difficult or that people will think they are abnormal" Sarah, however, studied physics, chemistry and mathematics. She was disappointed in her physics result "I had wanted to redo it, but my father was financially not in a position to help so I had to get a job."

She applied to GBC and, together with hundreds of others, sat the entrance examination.

Sarah was the only woman among 30 selected for junior technician training, which lasted 9 months. The engineering training school had a boarding house for the men but "I had to live at home and go in each day. Even up till today they haven't made provision for girls". She did very well and was encouraged by the head of the training school to continue to study. This she did in the Soviet Union. During the first year there she learned to read and speak

Russian, but also put in a lot of work catching up on the technical drawing not offered while at school. After six years she returned to GBC with her M.Sc.

She is now married with two small boys.

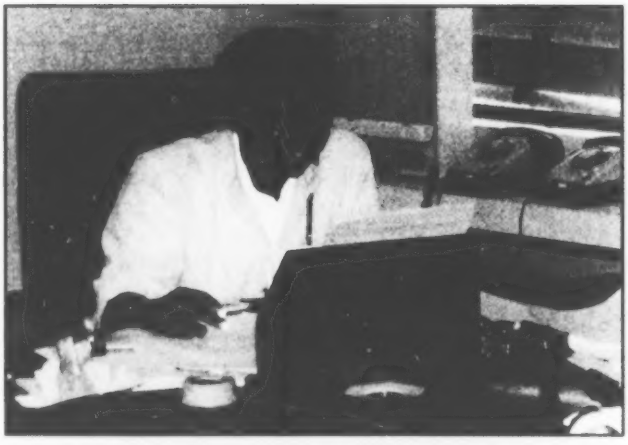
She believes "promotion comes to anybody, it doesn't matter whether you are a man or a woman, except perhaps when it comes to the topmost position."

As a member of the Engineering Committee at GBC her opinions are valued, but "most of the time they address 'gentlemen' before they realize I am there and they have to say 'lady and gentlemen'!"

She thinks it may be more difficult for women to give their minds to a career if they are anxious about their children and if their husbands do not help with getting meals ready. In spite of this, Sarah would recommend girls to do science and engineering, but "you've got to be very determined to be able to do it."

HOSPITAL DOCTOR

Dr. Asare studied medicine at the University of Ghana, Legon and now works at the Korle Bu Teaching Hospital in Accra. She runs a specialist clinic some days, on other days she takes her turn on the wards. Some nights she is on-call to advise junior doctors and she sometimes teaches students in the Medical School.



Dr. Henrietta Asare, Ghana

Early on she wanted to be an architect or an engineer, as mathematics was her best subject, but she became interested in medicine through Girl Guides and the Red Cross, which she joined while at Achimota School.

"We used to go out to the surrounding villages to dress wounds and treat people".

Henrietta was only three years old when her mother died. Her father was in Britain pursuing further studies in electrical engineering but she was lovingly cared for by relations until her father returned just before she passed the Common Entrance examination to Achimota School.

Her family, and especially her father, encouraged her to go into science, She also travelled many times with her father, visiting most places of interest in Britain and seeing a lot of the world.
At Achimota School the boys did not like it when she won the mathematics prize. At the beginning of the next term she reported:
"They didn't want me in the class and had taken my desk and things outside. I took my mathematics set and threatened to hit someone with it (I was very young at the time!); in the end they backed down!- - ". Later on, in the sixth form, she was the only girl in a class of about 60.

"There was a lot of competition ... but that was one of the best times of my life. There was no discrimination".

Promotion within the medical service depends on years of service for women as well as men. "If you do well they encourage you. I have had all the encouragement I need in my work".

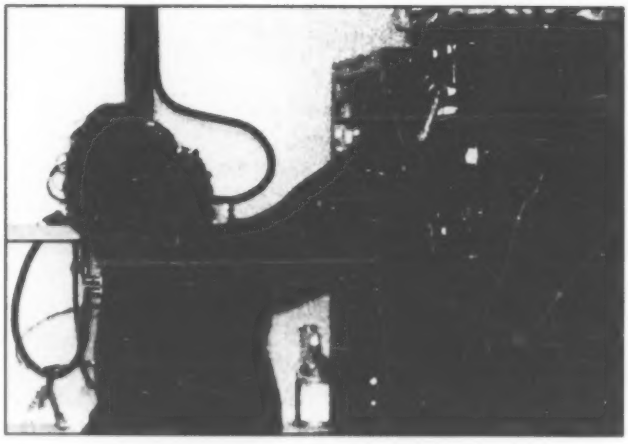
Dr. Asare finds the work is not well paid, but she gets great satisfaction from helping people to get well. "This has its sad side if a patient dies - it is hard to give the family comfort."

"Being a hospital doctor is very hard work," she says, "as they do not close for holidays like lawyers and accountants. She is also studying for further qualifications in internal medicine. Her two young sons do not understand! "'Mummy', they say, 'you say you are a doctor and yet you are always sitting behind books!' ... you have to have an understanding husband."

She would encourage girls to go into the sciences as there are a lot of interesting jobs to do, but they will have to be prepared to work hard.

"Science", she says, "is a moving subject - new things are always cropping up - you always have to be reading, but if you enjoy the work it is very interesting and satisfying."

CIVIL AVIATION ENGINEER



Mrs Mary Obeng, Ghana

Mrs Mary Obeng studied for a B.Sc in Engineering at the University of Kent, England. She holds a Post-graduate Diploma in Radar and a Diploma in French, for which she studied in Dakar, Senegal.

If you fly in or out or Accra Airport in 1989 your safety is probably in the hands of Mrs Mary Obeng. She is Manager Radio which means she has responsibility for all communications between aircraft and the airport. Under her management the technicians and technical officers maintain all the radar and landing equipment and the equipment for transmitting and receiving messages from all over the world. The fact that she is a woman does not affect her responsibility.

"I am one of the key figures in the planning of the airport - I am the engineer in charge."

There are not many women in such positions at present. She tells an amusing story of a visit to London: "I was at Heathrow Airport - they were shocked to find me in a skirt because they thought I was a man. They knew Mary was a woman's name, but thought somehow, in Africa, it was used for men as well!"

Mary was brought up by her grandfather. At one time she wanted to be a lawyer. "I was fascinated by the wig and the dressing up", she reports. But her grandfather said, "Look, you have collected all the maths prizes, you are good at science, why don't you think about a science career?" He was delighted when Mary later decided to go into engineering, and told her the sky was the limit.

Other people were not so encouraging: advice from her headmaster was that with her nice smile and slim figure she would make a good air stewardess. Mary says, "But although I'm at the airport, I'm working with radio and not as a stewardess."

Mary is concerned that teachers should not stereotype girls in this way. There is a lot of work to be done in text books also: "The sort of things boys are shown doing are

quite different from what is featured for girls." She says, "You look at yourself and you look at the picture and you stir yourself towards the picture in the book."

She believes properly trained careers advisers are needed to look at young people's abilities and to inform them of opportunities. She knows how important support from home can be: "If you are a father - a doctor or an engineer - then talk to all your children about your work, not just to the boys."

She says a lot of girls are very good at physics and maths and "there's a whole new world of computer science available. I think girls should grab this opportunity, there are so many interesting and exciting jobs now."

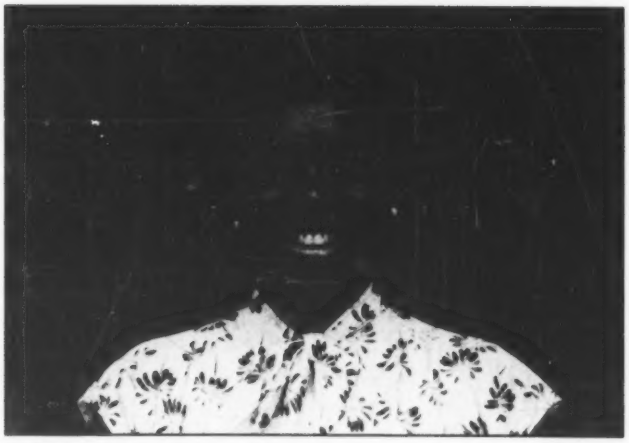
She laughs at the idea that becoming an engineer is unnatural for a girl. "Engineering needs brains, not muscles!" She says. "Neither does it stop girls getting married. If a man finds you very attractive, seeing you holding a screwdriver will not put him off ... if you walk into our house you could see me repairing a bike and my husband would be reading a newspaper. He is not a science-orientated person!"

She thinks her family life helps her work as a manager. "Women have a more sympathetic attitude towards workers' domestic problems which they cannot discuss with a male manager."

But she has to be well organized. "I plan my household chores very well so that in case I have to work late things won't fall apart at home. And sometimes it's a fight, but, after all life is itself a battle - you have to fight your way through everything."

CLINICAL PSYCHOLOGIST

Dr Sefa Dedeh holds a B.Sc in Psychology from the University of Ghana and a Doctorate in Clinical Psychology from Washington University in St. Louis, Missouri, USA. She works in the Psychiatric Department at the University of Ghana Medical School.



Dr Araba Sefa Dedeh, Ghana

She was the youngest of three girls in a family of six, who have all gone into the 'helping' professions. One sister is a children's doctor and the other a surgical nurse in Germany. Her oldest brother is a surgeon and the other brothers are teachers.

They grew up in a house on the campus of the school where her father was a teacher. "So we had a lot of space for running about," she says, "I had a good childhood with lots of fun."

Her mother had wanted to become a teacher also, "But", says Araba "in those days her father thought it would be better for her to be married than have a career. I was luckier; all those around me took it for granted that whether you were a boy or a girl you were supposed to do the very best you could".

Their mother taught them all to read before they went to school and their farther encouraged them to write and act in little plays.

Araba wanted to do science in the sixth form, but her maths was poor, so she chose economics, literature and history. In her first year at university she studied philosophy, economics, sociology and psychology. She decided to specialize in the last, obtaining a Bachelor's Degree in Psychology. She then went on to get her Ph.D in America.

She says, "I ended up with maths after all because for psychology you have to know quite a lot about statistics!"

Although her family encouraged her, others questioned why she was studying. She reports that people she met kept saying, "What are you bothering yourself doing this for, you ought to get married and have children."

When she was preparing to leave Ghana for the US to do post-graduate studies she was warned that no one would want to marry a woman with a Ph.D. She thought about this and reflected that as one got on in education one's choices of people to marry would become less. This was because there were fewer people with a high level of education and the outlook that goes with it. Towards the end of her postgraduate studies she married a schoolmate from Ghana who had just completed his Ph.D in Canada!

They have shared the care of their children but, while they were small, Araba gave up research.

She says, "I decided at that point that my priorities were towards my family rather than the career. It was still rather difficult - I remember at one time the car became a kind of nursery! We worked out our schedules so that he would babysit in the mornings when he had no lectures. I would work in the clinic until one, he would then put the babies in the car, collect me from work, drop us back home and dash off to his lectures!"

She thinks some employers would object to giving women jobs because they may take maternity leave, but others have found women more loyal. They stay with the company through hard times more than men do. Dr. Sefa Dedeh would encourage girls to go into the sciences at this time,

"I think, career-wise, there are a lot more opportunities in science and technology than in some other areas. Some girls are afraid of maths, as I was - it's not that bad! What it needs is someone to relate the concepts to daily life and then it makes sense."

BIOCHEMIST

Dr. Marian E Addy, Ghana

Dr Marian Addy studied Botany at the University of Ghana and holds an M.Sc and Ph.D in Biochemistry from Penn State University in Pennslvania, USA. She is now a senior lecturer in Biochemistry at the University of Ghana.

When she was in school in the 1950s, she says there was a general trend to discourage girls from doing science. "Girls were mostly in girls' schools where there weren't too many good science teachers and if they were in mixed schools it was not feminine to do the sciences. You would do the proper thing - history or some other course like that."

But Marian's story shows what a determined young girl can do.

She says, "My teachers asked me specifically not to pick the sciences because my chances of passing well would be better in the arts, but I refused. I think I was a little naughty when I was young. I liked to have my own way - I knew what I wanted to do. When they realised I wouldn't change my mind they stopped bothering me!"

She grew up as the middle child in a family of seven. Her father was a mechanic on the railways and her mother cared for the family. Both parents were concerned for their children's education. He did not especially press for science, just to do well at everything.

"We all liked and did go to school to a high level."

Their father constantly checked their grades, treating daughters and sons alike. She remembers her father saying that even if it meant he was left with only one pair of pants in order to send a child to school, that child would go to school. "My dad wanted me very much to be a medical doctor, but I was old enough to explain why I did not want to be a medic and he reluctantly accepted it. I did all those degrees," she says, "because early on I decided I wanted to be a lecturer at the university."

Much of her present work involves teaching students and she also carries out research into medicinal plants. "I enjoy

the teaching, but I try to involve my students in my research - this makes it more interesting."

This is what she says about her research:

"In most parts of Africa the bulk of the health care delivery system is still with herbalists who are in the little towns and villiages. I happen to believe that there is still a lot we can get from medicinal plants and there are two reasons for the work. One is that it may be possible to improve on the action of the herb and unless you know how it acts you can't improve on it. The other is that the medical doctors are mostly western trained, which means that they know nothing about herbs and need scientific evidence to persuade them that herbs have any value. So there is need for scientific research to build a bridge between the herbalists and the medical doctors."

Dr. Addy was responsible for introducing this research into the University of Ghana. Again she showed her independence, refusing to join research projects already established, when she returned from the USA, even though this meant difficulties in getting financial support and equipment.

She has contributed to the development of science teaching materials for schools, to get pupils interested in science. She is afraid there are still pressures preventing girls doing science.

She says: "My message to the young girls is that once you know what you want to do, believe in it and give it your best. I would like them to know that you can also be very happy and content as a female doing science. When you marry, choose a companion who has respect for you and the job you want to do. If you argue like that then you really don't worry about what society or your peer group thinks of you."

BOTANIST

Dr Angelina Mensah, Ghana

Dr Mensah studied Botany and Zoology at the University of Ghana, obtaining a general degree. She went on to specialize in Botany and especially in genetics and plant breeding, gaining a Masters degree from the University of Wales and a Ph.D from the University of Wisconsin, USA. She now teaches in the Botany Department, University of Ghana.

She says: "Plant breeding improves on our crop plants. If I had chosen to work in a research station I would be studying genetics of some of our crops to pick out the better ones to distribute to farmers. But right now I am teaching at the University, training more personnel to do that sort of thing."

This work is especially suitable for women to do, she thinks, because

"you could be working basically in the laboratory and have your experimental fields around, so it is not something that would take you away from home. If you are married with children you could combine the work easily with running a home".

She has two daughters - the elder one hopes to study law while the younger is interested to do something medical.

"I don't find any problem with my job and running a home with children; if anything, it is a sort of encouragement. When I go home, there is diversion from my job with my 8 year old trying to occupy my attention as she does homework. I find it a joy to have them around. Sometimes they accompany me to the lab., I give them some things to read and when I finish work we go home. The kind of job I am doing doesn't interfere with running my home at all."

Angelina comes from the Ashanti region where, she says, "they usually think a woman's place is in the home"

"My mother died before I was a year old, but my father gave me full support. Neither he nor my mother had been to

school, so he couldn't advise me on where to branch out, but he was pushing me to go ahead and study."

The only discouragement she experienced was from a few of her friends, some of whom married before finishing elementary school. "They thought I was too ambitious, that I was wasting my time. When I returned from holidays they would tease me, saying, 'as for you, you will remain a schoolgirl for ever.'

"Apart from that all the people who knew me from the village encouraged me. One of my elementary school teachers recently sent a message that he had been following my progress and would like to see me. When I visited him he told me he knew I had great potential and prayed for my success. I have a lot of well-wishers in the village and some who now work here in the city are proud to tell others about me and sometimes even claim to be a relation!"

She thinks attitudes are changing. "People see the way some women have progressed to high levels and they want their children to get to such levels. And people especially admire women scientists. I recently attended the Korle Bu teaching hospital and when the consultant saw my file he called the nurses in and said 'Here is a woman with a PhD and she even studied science, isn't that nice!' He seemed very pleased."

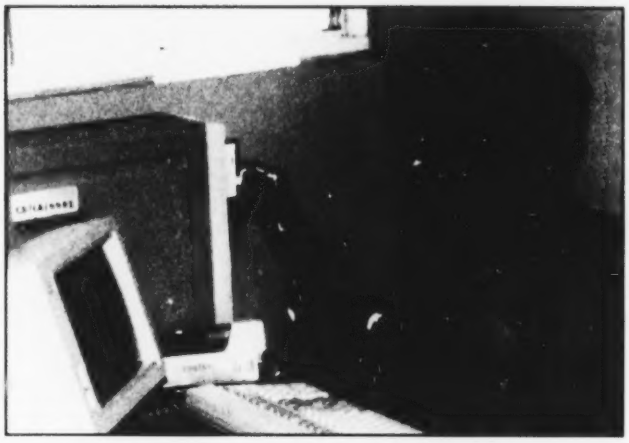
Being educated need not cut you off from your family and friends. Dr Mensah returns frequently to her village even though her father is now dead and she meets with a group of school friends every month.

"This is a form of relaxation for me " she says.

Dr. Mensah has talked with girls about science. She reassures them that it takes no longer to graduate in science than in humanities. She finds they are still concerned that becoming educated might prevent them finding a husband. "But, she says, "You'd think a man would be proud that his wife is educated - if someone genuinely wants you it isn't a problem!"

SYSTEMS ANALYST

Mrs Caroline Kitcher is a Systems Analyst and lectures in Computer Science at the University of Ghana, Legon. She has a B.Sc degree in Mathematics from the University of Cape Coast, a graduate Diploma in Computer Science from the University of Ghana and an MSc degree in Computer Science from University of Aston in Birmingham, U.K.



Mrs Caroline Kitcher, Ghana

"Companies come to us asking for students to work with them." She says, "There are so many fields that have not been programmed, that have not been computerized. We teach the students first to use packages already developed and to write their own programs. At a more advanced stage they learn systems analysis, that is identifying problems within an organization, finding solutions and converting these into programs to computerize the organization."

"The work is a bit demanding; you have to have patience but it's not hard. If the interest is there you will definitely succeed and your success will give you market value and you will have a place in any organization."

It is important to have a good background in mathematics. Caroline is concerned that many girls believe mathematics is difficult even before they try it.

"It must be something put into us at an early stage and if you
think it's difficult then it becomes difficult. I don't think its a gift. I wouldn't say I was a genius or was very good at school, but I liked mathematics and that is what has moved me on to this point. Mathematics is not a frightening subject at all and I would encourage girls that they should take it up because it can take them further on than any other subject.

"After I took my degree in mathematics I went to teach in Achimota School where I heard about a service course in computing. I asked if I could sit in on some sessions and found it was something I was very much interested in. I enrolled for the Graduate Diploma course and found it so good. I did so well in it - better than I expected - that the Head of Department asked me to come and work at the

university. I accepted and developed programs for the university - admissions and administration - and taught on some introductory student courses before getting a scholarship for the M.Sc course in England."

Caroline married at that point. Her husband has a degree in agriculture and works in management. They have three children: two girls aged 6 and 4 and a baby son. She has this advice for girls thinking about further education:

"Although the older generation may ask when is it going to end and when are they getting a grandchild, there's still time. By the end of the first degree you are maybe 23 and after the second perhaps 25 - that's still not too old! And you can always mix marriage with your work.

"This year has been a bit hard, we are short-staffed in the department at present and I've been busy teaching courses, grading students and developing programs and software packages. But I can see that it's not going to be so bad next year because the baby will be on his feet. Even now I get time at weekends to visit friends or go to a film show or even travel to my home town, because I don't come from Accra.
That puts me in a good mood for Mondays!"

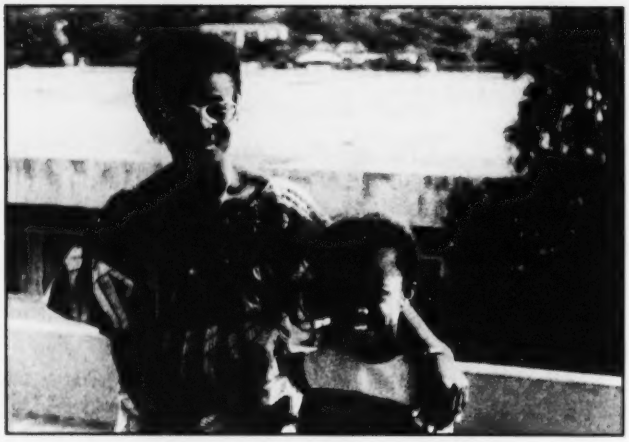
Although Caroline's father did not have much education her mother is a teacher and she has been the major influence in the family.

"She wanted us to have the opportunities she missed and so she was always pushing us. Whenever I did well she pushed me on to the next stage. I am the first child, so I didn't have anyone to follow. Now the younger ones are looking up to me - the cousins as well, because my mother was the eldest of her brothers and sisters, too."

Other people in her home town were not so sure that Caroline was doing the right thing at first.

"While I was still studying they thought I was getting too late to have kids, but now they are so happy that I have achieved both. Now the parents tell their girls to look up to me because if you do well in school and carry on with your education it does not necessarily mean that you are not going to get married. Having a child is an important thing in our society and so it is an achievement to get both. In fact most of the women who have risen to the top are married women."

ZOOLOGIST



Dr. Yaa Ntiamoah Baidoo, Ghana

Dr. Baidoo lectures in Zoology at the University of Ghana, and she is the Project Officer for the "Save the Sea Birds" Project of Ghana.

She was a student at the University herself and gained the only first class honours degree ever awarded in the 40 years of the department, specialising in Entomology. She also holds a Ph.D in Parasitology from the University of Edinburgh, Scotland.

She says, "I started my career with the Department of Game and Wildlife as an Assistant Game Warden. I undertook research projects on grass eaters and elephants, did some work on bush meat utilization and on vertebrate pest problems. I became Head of the Wild Life Research Division and Deputy Head of the Department before joining the University staff.

"The project I now work on is sponsored jointly by the Government of Ghana, the Royal Society for the Protection of Birds and the International Council for Bird Preservation. The aim of the project is to protect migratory sea and shore birds which breed in Europe and spend the winter in Ghana. I monitor the bird populations, their distribution and movements and study their breeding biology.

"I find the work extremely interesting. It is not office-based; it gives me the chance to go out in the field, to the beach; that is what I want. My work is what others do as a hobby in some countries - I am very lucky!

"There are lots of opportunities for trained girls in this work. There is no discrimination and the wildlife in this country is facing a big problem of staff shortage. The only thing is you've got to get the right qualifications. You have to do science subjects: physics, chemistry and biology, with English and mathematics and in the sixth form science subjects again, with perhaps agriculture or geography. Anyone with a basic science degree can go into wildlife. You are given specialist training in wildlife management after you've joined the department."

Yaa was born in a small village in Ashanti-Akim. Her father could read a little, having reached primary three, but her mother had had no schooling. Yaa was the sixth of eight children and the only one to go on to secondary school.

She says, "In our area the belief was that education for girls was not important. Boys were encouraged to go to school but girls were expected to stay at home and help the parents, but, in my case, my mother was very keen that I should continue - I owe a lot to her. When I passed my Common Entrance Examination it took my head teacher about two hours to persuade my father even to let me attend the interview because he felt it would be a waste of money to educate a girl - tomorrow she marries and all that is wasted. But my mother persisted. She worked very hard, got me into secondary school and fortunately I had a scholarship, so that helped.

"It was my teachers who encouraged me to go into science. I did well at the 'O' level examinations and my teachers literally insisted that I should do science because I was very strong in the science and I did it!"

Yaa had attended a girls' school for her secondary education until her 'O' level examinations, but then transferred to a co-educational school for her sixth form work. She was surprised to find that the girls there felt 'whatever I do a boy will be top of the class, so why bother?'

"I did not believe this," she says "and all the teachers there encouraged me."

The only time she met discrimination was when she applied for her first job. The interviewing panel admitted she had the best qualifications but said, because she was a young woman, she would soon marry and leave to have children.

She remembers, "I said to them I already have children and told them I had my second child during my final year at university and I still managed to get a First Class, so it makes no difference if I am a woman or a man, but they insisted they wanted a man!"

She thinks attitudes are changing, but says:

"This is where women can get together and encourage each other and find ways of taking care of our families so we will spend more time at work. If our husbands are helping to care for the children and sharing responsibility, then we will be able to spend more time at work."

Dr. Baidoo has four children: two boys and two girls between the ages of 5 and 18. "I think they are all taking after me," she claims, "the boy who is in the Sixth Form is doing

physics, maths and chemistry and the girl in Form Three wants to do science. The other two are too young to specialize, but even the little girl thinks she will be a medical doctor!"

She knows science to be an exciting area and wants to encourage girls to go into it.

"My only advice is", she says "that they've got to be determined, because it takes time and hard work, but I believe if you have the ambition and you have the determination, you can perform as well as any man, or better!"

STATISTICIAN

Mrs Marjorie Danso-Manoo, Ghana

Mrs Marjorie Danso-Manoo lectures in Statistics at the University of Ghana. She holds a Bachelors' degree in Economics and Statistics and a Diploma in Population Studies, both from the University of Ghana and an M.Sc in Medical Demography from the London School of Hygiene and Tropical Medicine.

She explained the course she teaches: "First I teach elementary statistical methods, measures of dispersion and so on. In the second year the students take more specialized courses, one in sampling and another in the design of experiments.

"Statistics is not boring at all, in fact it is the exact opposite. I find it very interesting looking at various types of data, especially in my own research area - medical statistics - trying to see patterns in the data that one has. It is the best thing I think I could have done.

"I mostly work on population demography: how many children are born, how many are boys and how many are girls, what weight they are at birth and how many women die in childbirth.

"We need this for planning and to improve survival. If, for example, 500 children are born this year then we know we have to plan for
a certain number of school places six years from now."

Marjorie's mother is a teacher in primary school. After training in Ghana she went to Selly Oak College in Birmingham, U.K., to do a Frobel course. Her father was an accountant with the University of Cape Coast before he retired. They both encouraged Marjorie in her studies.

"My message for young girls," she says "is that they shouldn't be scared of doing mathematics. A lot of people have got the impression that mathematics is very difficult and so it is only for boys. But neither of these things are true. Girls can make it if they try hard.

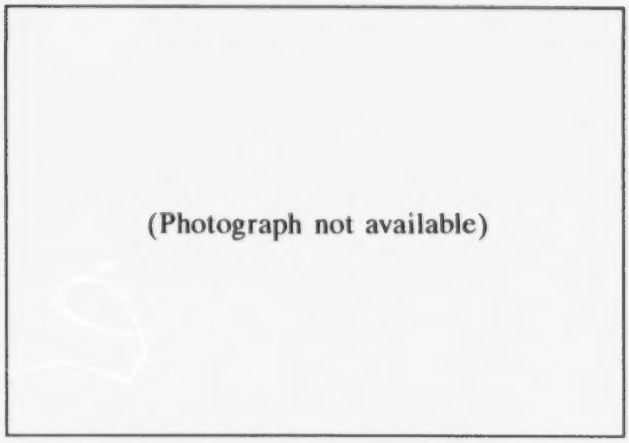
"And pursuing a course in statistics did not disturb my marriage plans in any way. I am just expecting my first

baby. I had to rest a bit more at the beginning, but it didn't interfere with my teaching. I just had less time to give to my research. If you are married and look after your home and your family you do have less time than others, but a career and family life are compatible. I still have time for dress-making and my main hobby which is embroidery. The pictures on the walls here are my work."

MATHEMATICIAN

Ms Parker-Bennin teaches mathematics at Achimota School. She holds a B.Sc (Hons) degree in Mathematics from the University of Ghana.

She was educated herself at Wesley Girls School, Cape Coast. There she topped the class in Form 1 examinations in science and mathematics.



Emma Parker-Bennin, Ghana

"I realised that I had a potential that I should pursue so that prompted me to work even harder. When the others were not doing home work I was prepared to do it and even more than the teacher had given us," she explained.

"Right from elementary school my mother was maths inclined, so any time I brought work to the house she showed interest in what I was doing. I went to a girls' school and the teachers were mostly women. They were so much interested in the subject and in us, so they encouraged us a lot. If you showed the least bit of interest they encouraged you to improve. But even so, there were only three of us doing maths in the Sixth Form. In my set there were 12 doing science but I was the only science student doing maths; the other two were arts students.

"At Achimota School only about 20% of science students in Form 4 are girls and very few girls do science in the Sixth Form. The Ministry of Education realises the problem and last summer they organized a girls' clinic here - they had seminars with women scientists, they visited places where women were in control and that sort of thing - just to encourage girls to do science. Once a girl decides to do a subject she does as well as a boy. It is when they are not sure themselves that they have this wavering attitude to a subject.

"I think girls should stand up and compete with the men. They can do exactly what the men are doing. They should just have the determination and discipline and all will be well with them.

"I don't think it's true that if girls pursue science subjects they find it difficult to get a husband. Attitudes are changing; in the past, back at home, men used to be the

bosses, now women are also educated just like the men. We are used to discussing things, not just accepting decisions made for us. Some men like educated women because it helps them a lot to have an equal partner who can manage things as well.

"I have three children, but as a mathematics teacher I am home soon after 13.30 hours. You decide to do things according to your schedule. I know people who are doing other jobs in the science field and they are able to manage too."

NUCLEAR PHYSICIST

Dr Aba Andam, Ghana

Dr Andam is a Senior Lecturer in the Physics Department of the University of Science and Technology at Kumasi. She holds a B.Sc degree in Mathematics, Physics and Education from the University of Cape Coast in Ghana, a Master's degree in Applied Radiation Physics from the University of Birmingham and a Doctorate in Cosmic Radiation Physics from the University of Durham.

She explains that it is important for Ghana to have a nuclear physics programme: "Like any other country we need to make full use of the potentialities of nuclear power by training people to work in the field and by supporting active research groups who will work into the peaceful uses of nuclear power. Examples of these are the generation of electricity, uses in agriculture such as seed preservation and quality seed development for plant protection and the use of nuclear physics in medicine. At the Korle Bu Hospital there is a group working on medical physics; they use nuclear radiation to detect or diagnose diseases and it will be nice if Ghana can also have one hospital at least at which patients who need radio-therapy can be treated. We do not have this yet, but it is in the pipe-line.

"We prepare students who are going to teach to be able to teach the nuclear physics aspects of the secondary school syllabus. We also prepare students to work for the Ghana Atomic Energy Commission in research into health physics, monitoring people working with radiation. And we want to be sure that any students who go on to post graduate work outside Ghana don't feel so green, but can stand on their own feet and cope with the courses."

Dr Andam is the only woman in Ghana with qualifications at doctoral level in nuclear physics. One woman student graduates this year and two others have specialised in nuclear physics in the past and are now teaching in schools. She explains how she came to work in the field:

"As a child I was interested in nature and wanted to be a teacher. After secondary school I got admission to the University of Cape Coast which specialises in teacher

training. At the end of the course my degree was good enough for me to go on to post graduate work. I was interested in nuclear physics from the courses we did in the final year of our undergraduate course and I got a scholarship from the International Atomic Energy Agency to study at Birmingham University.

"My teachers and lecturers at the university all encouraged me, but it was my father who pushed me every inch of the way. He believed very much that I should be sent to school - my mother also helped, although when I got to the university and beyond I believe they did not know exactly what it was all about, but they were prepared to give me every encouragement as well as moral and financial support."

Aba was the eldest of five children, the others being all boys. One brother has a PhD in Economics, another is doing post-graduate work in Chemistry, while the others are still at school.

"My parents were not academics," she says, "in fact they had no formal education whatsoever. My father was a jack of all trades. He taught himself to read and write Fanti and my mother was very good with her hands. She can mend things and solder and so on.

"In the village they know me as a local girl. My father is dead, but they know me as the daughter of this man. When I go there I am just part of the system. I try to point out to people around me the importance of pushing their daughters through formal education and I encourage the girls in the immediate family to pursue courses. When they do I help them financially if I can.

"Although in Ghana there are equal opportunities for boys and girls, a lot depends on the family situation. In some families, if there are financial problems it would be the girls who would have to stop schooling, not the boys."

She recalls some prejudice at her mixed primary school:

"There was a boy in my class who just could not cope with the fact that a girl was ahead of him, so I got a lot of bullying from him. My secondary school was a girls-only school so there was no problem and at the university, although I was the only girl in my class, the boys were very pleasant and nice."

Dr. Andam draws great comfort from her religion:

"I became a Christian in secondary school," she says, "and I believe that God has a package planned for my life and what I am doing now, the scholarship I got, the courses I did and everything else is part of God's plan for me." This faith supported her at a time of great discouragement:

"There was an occasion during my post-graduate work when I had a research supervisor who was a real male chauvinist! I was pregnant and had done a whole year's work when I went to him to say that I needed a few weeks' leave to have the baby. He just went wild - he didn't even know I was carrying a baby, probably because I was wearing a big lab coat or he was totally blind to me as a person. He was so furious he said he didn't want to see me again. This incident resulted in my changing direction but in the end my new supervisor was extremely pleasant and I am still in touch with him. I think it's all part of God's plan for my life - I really was not supposed to be in that place at that time!"

Dr Andam's husband is a Civil Engineer, lecturing at the University of Science and Technology. They married immediately after she completed her first degree. "My husband has given me every support he could throughout my post-graduate work and my subsequent career," she says. They have four children, three girls and a boy.

"You have to organize your family situation to be able to do your own work well, but you have to give the family time, also. I will encourage my daughters to go into science and technology but at the end of the day what will impress the child most is your life. If my daughters find that I would rather study than look after them they will obviously be put off science. On the other hand if they find that I try to make time for them in spite of my busy schedule as a science lecturer, then they may be encouraged to take up science. But again, it depends on each child's capability, I believe that, whatever a woman does, she must be scientifically literate. We are now in a technological world - they cannot shut their eyes and their minds to science and I would want them to learn about science whatever profession they finally choose."

SECTION 6

REVIEW OF CAREER OPPORTUNITIES IN SCIENCE AND TECHNOLOGY

The Agricultural Sector

Agriculture is the mainstay of most African economies. The contribution of African women to agriculture and especially to food production is well aknowledged as crucial to family sustenance and to the resolving of the prevailing food crisis in the continent. Such contribution has been quantified at a substantial 80 per cent of sub-Saharan Africa's food. In Kenya, women provide 70 per cent of the total labour force in agriculture while in Zimbabwe such contribution is estimated as two-thirds of all agricultural work (UNICEF, 1987). It is clear then that agriculture offers the greatest opportunity for female employment where women are concentrated in subsistence, unskilled farming.

The last decade witnessed the accumulation of knowledge that could double food production in Africa, natural calamities notwithstanding. In order for this to happen, it is necessary to re-orient policy and resources towards the rural small-scale farmer and to women farmers in particular. One of the most crucial resources for improved agricultural and food production is the dissemination of existing knowledge to women. Available knowledge includes that on improved seeds appropriate for different soils and climates, new techniques of inter-cropping, soil and water conservation methods, mulching and nitrogen fixation, the proper use of manufactured fertilizers and pest control products and various aspects of animal husbandry. Appropriate knowledge also exists on improved post-harvest handling of agricultural products, food storage, processing, preservation and preparation which are all women's roles.

One of the greatest challenges facing African women's education both formal and informal is to ensure the free flow of information to women farmers and feedback to research institutions derived from the experiences of women farmers.

The current quest for improvement in agricultural production resulting from Africa's food crisis and the overwhelming external debt demands substantial increases in the number of skilled agricultural workers. Agricultural training offered by most institutions in the region demands knowledge and passes in a minimum of two subjects among chemistry, physics, biology, physical science and agriculture (see Appendix 2 for level of qualification). Most countries are now stressing the recruitment and training of female agricultural extension officers because they have proved to be more effective than male officers in communicating with women farmers.

Numerous careers exist at various levels in agriculture and livestock development. Technical officers in agriculture engage in agricultural extension services, livestock and dairy work, research, range management, hides and skins and inspection and in teaching.

Current emphasis on environmental concerns and the fight against deforestation and desertification has created increased opportunities in forestry. This career has attracted very few women so far although women's groups are very much involved in tree planting and environmental conservation measures.

University level training in agriculture leads to career opportunities in agricultural extension, research and administration at different levels (Division, District, Province and Central), and as agricultural engineer, farm manager, agronomist, soil chemist and soil surveyor, veterinarian, zoologist and farmer and agricultural economist. All these fields also lead to opportunities for advancement through further studies for those who are able and keen.

Fisheries

The majority of women currently engaged in the fisheries industry are in the field of processing. Yet training opportunities exist for fisheries assistants that lead to administration, supervision and extension work for those with good passes at 'O' level (or equivalent) in mathematics and a science subject, preferably biology.

This sector also offers opportunities for training in research (Laboratory or research assistants) whereas competition increases, a candidate must have 'O' level credits in mathematics and English and good passes in chemistry, physics and biology.

Some countries offer on-the-job training for fish-scouts whose roles include the gathering of statistics and enforcement of fisheries related legislation.

Water Development and Management

Opportunities exist for training towards a whole range of technical work in water development and management. Good passes in physics or physical science, chemistry and mathematics are required by a candidate to qualify for training as surveyor, laboratory assistant, draughtsman, inspector (mechanical, ground water, sewerage and water supply), water bailiff, hydrology assistant, pollution control officer and Training Officer among other areas of specialization. At the professional level the water sector offers opportunities for civil engineers, hydrologists, sanitary engineers, mechanical and irrigation engineers, biologists, chemists and surveyors.

Wildlife Conservation

Most countries have Wildlife Conservation programmes that offer careers in National Parks and Game Reserves which involve care-taking for the welfare of animals, prevention of poaching and regulation of visitors. The African Wildlife Management College in Moshi, Tanzania provides training for wardens and their assistants in the Eastern African region.

Although policewomen are a common feature in most countries, women have as yet to enrol as rangers in the National Parks. The roles of rangers as field workers patrolling and enforcing Park rules and guiding visitors, are similar to those of the Police.

The number of female research scientists in the field of wildlife management is however encouraging.

The Health Sector

Traditionally, the majority of career opportunities for women in the health sector have been concentrated in Nursing. The increased entrance of women into higher education in the sciences has opened up other career opportunities not only in health institutions but also in industry, laboratories and private enterprises at various levels. All courses in the health sector demand good passes (see Appendix 2) in most science subjects from the earliest: biology, physical sciences, general science, health science, physics, chemistry and mathematics.

Careers in the health sector include Nurses, Medical Assistants Clinical Officers, Doctors, Dentists and Dental Assistants/Technologists, Veterinarians, Pharmacists and Pharmaceutical technologists, Dieticians, Health Nutritionists, Optometrists and Opticians, Physiotherapists and occupational therapists, X-Ray Technicians, Radiographers, Public Health Officers and Othopaedic Technologists, among others.

The Tourism Sector

Although many women have been training in institutional management and are holding positions as Housekeepers, cateresses, canteen supervisors and school matrons, few women hold managerial positions in the numerous hotels in the region. The posts of Cook, Managers (General, Food and Beverages, Floor) and senior waiters and stewards, tour/travel clerks and receptionists require a good pass in mathematics at 'O' level or equivalent.

The Commercial Banking Sector

Good performance in mathematics is a condition for entry into banking and insurance while computer training demands

an aptitude for working with computers. This is a rapidly expanding field in Commonwealth countries and women should be encouraged to take emerging opportunities at all levels.

Other Fields of Technology

Although women in Commonwealth African countries have already made their presence felt in most careers at the professional level, the number of female technicians is low considering the increasing number of girls completing secondary school education in each country. Individual countries have forecast significant growth in the industrial sector with emphasis on small-scale industries.

Currently, most industries employ women as unskilled workers, for example in labelling and packaging. In the event of mechanization, these are the jobs that lead to redundancy. The need for women and girls to gain skills cannot therefore be over-emphasized.

The technical field offers a wide variety of careers in all kinds of construction, engineering and research from technician to professional levels. The construction industry absorbs masons, plumbers, draughtsmen, electricians, carpenters/joiners, painters, architects, engineers and surveyors (quantity and general practice). Engineering varies from mechanical, electrical, civil, aeronautical, building, plant, mine and quarry, marine, telecommunications, safety, radio, television, chemical and electronic engineering in addition to the categories covered under water development. Although not all countries have television the video is a common feature of most development programmes.

At the craft level, various institutions offer training that leads some graduates to formal employment in public and private sectors while the major thrust for job creation in most countries now is towards self-employment in small-scale ventures. Besides dressmaking and tailoring, technical institutions offer courses for masonry, carpentry, woodwork, plumbing, painting and decorating, fitting (electrical, pipe, factory, mechanical), panel beating, motor mechanic, welding, plant mechanic, auto electrician, power plant electrician, electronics mechanic and refridgeration and air conditioning mechanic.

The Motherhood Role

The gains to be made by having children whose early socialization has been influenced by women who are scientifically oriented, have as yet to be documented. It is widely acknowledged nevertheless that women's education is a proven independent and powerful factor with a tremendous impact on all sectors of development. Among the identified areas with greatest impact is the linkage between the education of women and significant reduction of infant mortality. Women's education is also linked with improved

nutritional feeding methods at the family level. The close interaction between mothers and their children is also bound to exert a great deal of influence on the latter's attitudes and aspirations. Parental influence on children's career choices is clearly evident especially among families with well-to-do parents in farming, business or professions.

Considering that between 60 and 80 per cent of women in Africa live in the rural areas, given appropriate support, a scientifically aware mother will provide leadership in scientifically oriented development measures to prevent environmental degradation, including soil erosion. She will also participate more effectively in the promotion of improved agricultural and especially food production. Her capacity for improved farming and animal husbandry will provide children with the motivation and practical experience needed to reinforce formal learning in a real-life setting. She will also provide the model very much needed in Africa for the conservation of the meagre energy resources - fuel wood, charcoal, gas or even electricity, and water resources.

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APPENDIX 1

WOMEN IN EDUCATION, TRAINING AND EMPLOYMENT IN SELECTED AFRICAN COUNTRIES

ZIMBABWE

Table 1: University of Zimbabwe Science-Based Courses Enrolment by Sex, 1981

Faculty	Male	Female	Total	Female as % of Total
Agriculture	83	18	101	16%
Engineering	138	0	138	0%
Medicine	249	83	332	25%
Science	143	32	175	18%

Table 2: Female Enrolment at Bulawayo Technical College 3rd Term 1981

Division	Female	Total	Female as % of Total
Mechanical Engineering	0	301	0%
Electrical Engineering	1	197	0.5%
Maths and Science	67	222	30%
School of Catering	4	47	9%

Table 3: Female Enrolment at Harare Polytechnic 3rd Term, 1981

Division	Female	Total	Female as % of Total
Civil Engineering	17	327	5%
Printing and Graphic Arts	29	159	18%
Science Technology	35	259	14%

Table 4: Medical, Dental, Other Health and Veterinary Services Provides, 1981

	Female	Total	Female as % of Total
Medical Doctors	50	541	9%
Medical Assistants	952	1,151	63%
Dentists	10	67	15%
Dental Assistants	52	73	71%
Veterinarians	7	158	4%
Pharmacists	4	177	2%
Dieticians & Other Health Nutrition	16	25	64%
Professional Nurses	2,173	2,388	81%
Nursing Personnel	932	1,137	82%
Optometrists and Opticians	7	24	29%
Physiotherapists and Occupational Therapists	72	88	82%
Medical X-ray Technicians	78	97	80%
	4,423	6,498	68%

Sources:
Tables 1, 2, 3 and 4 are adapted from Tables 19, 20, 21 and 9 respectively in ILO (1986) Women's Employment Patterns, Discrimination and Promotion of Equality in Africa, The Case of Zimbabwe.

TANZANIA

Table 5: Number of Schools with Form V-VI Science Subject Combination, 1981

Subject Combination	No. of Girls' Schools	No. of Boys' Schools
Phy., Maths, Chem.	1	7
Phy,, Chem., Bio.	3	11
Pure Maths, Appl. Maths, Phy.	0	3
Chem., Bio., Geog.	1	0
Pure Maths, Appl. Maths, Engineering Phy.	1	2

Table 6: University of Dar-es-Salaam Female Students in Science and Technical Courses, 1978-82

Course	1978	1979	1980	1981	1982
Science	32	68	48	56	34
Agriculture	8	17	9	8	5
Veterinary Science	0	2	5	2	3
Forestry	0	2	0	0	0
Geology	3	3	3	3	2
Engineering	4	6	7	8	5
Medicine	9	14	9	12	4
Pharmacy	6	11	10	7	1
Dentristry	0	3	4	5	2

Table 7: High and Middle Level Female Employment in Tanzania

Job Category	No. of Females
No Post Indicated	118
Physical Scientists & Related Technicians	34
Architects, Engineers & Related Technicians	28
Aircraft and Ship's Officers	1
Life Scientists and Related Technicians	270
Medical, Dental, Veterinary & Related Workers	153
Nursing/Midwifefy	1,494
Statisticians, Mathematicians, Analysts & Related Employees	12
Professional & Technicians not classified above	358
TOTAL	2,468

Sources:
Tables 5, 6 and 7 are adapted from Tables 72, 70 and 60 respectively in ILO (1986) Women's Employment Patterns, Discrimination and Promotion in Africa. The Case of Tanzania.

KENYA

Table 8: University of Nairobi Female Enrolment in Science-Related Courses, 1973-1983

Course	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Agriculture	3	2	5	7	10	12	17	21	23	0	17
Veterinary	1	2	0	6	5	5	10	3	12	0	5
Engineering	0	1	2	1	0	1	1	6	2	0	3
Architecture	1	0	0	0	0	0	0	1	4	0	1

Source:
Adapted from Njenga, A.W. (1986), "Career Patterns and Prospects Among Women and Men Agriculturalists, Veterinary Doctors and Engineers." A report to Kenya Education Research Awards, November, 1986.

Table 9: Female Employment in Science-based Occupations, 1981

Occupation	Females	Total	Females as % of Total
Architects, Engineers and Surveyors	45	4,701	1.0%
Draughtsmen & Engineering Technicians	24	3,820	0.6%
Doctors, Dentists, Pharmacists & Veterinarians	223	1,629	13.7%
Nurses and other paramedical staff	11,180	15,871	70.4%
Chemists, Physicists, Biologists, Zoologists & Agronomists	426	3,558	12.0%
Technicians in Physical Sciences & Life Sciences	545	6,206	9.0%
Statisticians, Mathematicians, Systems Analysts & Economists	66	809	8.2%
Statistical Officers, Mathematical and related technicians	40	1,011	4.0%
Aircraft and Ship Officers	4	756	0.5%

Source: Kenya (1984), Employment and Earnings in Modern Sector,
Central Bureau of Statistics, Nairobi.

APPENDIX 2

Entry Requirements for Professional Training and Education

The table below provides entry requirements for professional training in agriculture, health, engineering, commerce and banking and architecture. The information is tabulated by level of training (certificate, diploma and undergraduate degree) and for a few Commonwealth countries in this region. While the information is not as comprehensive as we would have liked, it is nevertheless illustrative of the importance of training in science and mathematics for entry into the leading professions and sectors of the societies. This stresses the importance which should be attached to improvement of the quality of teaching of science and mathematics for girls at primary and secondary levels. The fields indicated on the table are not the only areas requiring adequate preparation in mathematics and science. The application of new technologies like computers, communication and information technologies like computers, communication and information technologies into all sectors of society requires good grounding in mathematics and science.

ENTRY REQUIREMENTS TO PROFESSIONAL AND DEGREE TRAINING IN SELECTED COURSES AND COUNTRIES

COUNTRY	KENYA	ZAMBIA	TANZANIA	ZIMBABWE	MALAWI
PROFESSION Agriculture:					
Certificate	K.C.E. or equivalent at least a credit pass in either Biology, Physics, Chemistry and Agriculture.		'O' Level Certificate and practical experience.		'O' Level G.C.E. or M.C.E. or any other internationally recognized certificate with at least 5 credits including English and Maths.
Diploma	'A' Level Principal Pass in either English Language, Maths, Biology, General Science or Chemistry.	'O' Level Certificate.	'A' Level Certificate or a certificate in agriculture.	1st or 2nd class Certificate with a credit in English, Maths and a science subject or 5 'O' Level credit passes including Biology or another science subject.	Good pass in Biology and physical science or in General Science in place of Biology and Physical Science
Degree	Principal passes in Biology and Chemistry and at least subsidiary passes in Physics and Maths. Other: Diploma from a recognised agricultural or veterinary college.	5 passes at GCE 'O' Level including Maths, Chemistry or Physics/Physical Science or 5 passes at Cambridge Overseas School Certificate level with specific restriction on overlapping subjects.	Principal passes in Chemistry, Biology (Botany/Zoology) Geography, Physics or Maths, plus science subjects at 'O' Level	'A' Level pass at least two of the following subjects: Biology, Chemistry or Physics or Maths and a pass at 'O' level in Biology, Maths, Chemistry, English.	A Diploma from The University of Malawi.

COUNTRY	KENYA	ZAMBIA	TANZANIA	ZIMBABWE	MALAWI
Health:					
Certificate	KCE Division I or II or its equivalent with 7 passes including English and at least 2 science subjects.	5 'O' Level passes or an approved equivalent	Trained Nurse Midwifery 4 years experience or 'O' Level with credits in any 3 science subjects Age limit 17 years	5 'O' Level passes or their equivalent including English.	MSCE with credits in English, Maths, General Science or Physical Science and Biology.
Diploma	KCE with 6 passes and Kenya Registered Nurse (KRN) Certificate and Certificate of Competence in practical nursing.	Passes in 5 subjects at 'O' Level or an equivalent certificate of experience as a nurse	'A' Level with credit passes in science subjects. Age limit 20-25 years for Medicine Course.	'O' Level passes in English, Maths, Biology, Chemistry, General Science, Physics, Physical Science with English as compulsory. Depending on the course, 2 years of relevant experience or State Registered Nursing qualification may also be required	'O' Level GCE or MSCE or any other internationally recognised certificate with at least 4 credits including Biology and Physical Science and one other science subject. 'A' Level of at least 'B' Grade holders may enter Diploma Course at 2nd Year.
Degree	3 higher certificate Principal in Biology, and Zoology	5 passes at GCE 'O' level or 5 passes at Cambridge Overseas Certificate in relevant subjects	At least 2 Principals in approved subjects at 'A' Level or equivalent including Physics, Biology, Zoology or a pass in Mature Age Entry Examination	Passes in 5 subjects at GCE 'O' Level including English and Maths. Passes at GCE 'A' Level or equi- 2 of the following: Biology, Zoology, Maths, Physics	Diploma in the field with a credit or distinction.

BEST COPY AVAILABLE

COUNTRY	KENYA	ZAMBIA	TANZANIA	ZIMBABWE	MALAWI
Engineering: Certificate			'O' Level Certificate in technical subject		
Diploma	Principal pass at KACE in Maths (Applied and Combined) and Physics or any other internationally recognized equivalent certificate.		'A' Levels with 2 Principals or 1 Principal and 2 passes (subsidiaries)		'O' Level GCE or MCE or any other internationally recognized certificate with at least 4 credits (including English and Maths) and one other science subject. Students holding 'A' Levels of at least Grade 'B' may enter 2nd Year of the Diploma Course.
Degree	Principal passes in Maths (Pure, Applied or combined) at KACE, Physics, Chemistry or Physical sciences at KACE or KCE or any other recognised equivalent.	'O' Level GCE with passes in English, Maths and 2 other subjects for School of Natural Sciences. Entry to School of Engineering is from 1st Year Natural Science.	Principal passes at A Level in Maths, Applied Maths and Physics. A pass in Chemistry at 'A' or 'O' Level may be a requirement for some courses. An Equivalent Diploma/Certificate may suffice.	5 'O' Levels including English Language plus 'A' levels in Maths, Chemistry and Physics	Diploma in the relevant field with a credit or distinction.

COUNTRY	KENYA	ZAMBIA	TANZANIA	ZIMBABWE	MALAWI
Commercial Banking. Management					
Certificate					M.S.C.E. with credits in English and Maths or a satisfactory performance in Aptitude Test.
Diploma		'O' Level Certificate	'O' or 'A' Level certificate	5 Aproved subjects at 'O' level including English, Maths, Accounting and Statistics and further approved qualifications and experience.	'O' Level GCE or MCE or any other internationally recognised certificate with at least 5 credits (including English and Maths).
Degree	Credit pass in Maths at EACE or KCE or any other internationally recognisd equivalent certificate	5 GCE 'O' levels or 5 passes at Cambridge Overseas School Certificate level including 'O' level in English, Maths, Geography or History or Accounting or Economics or Commerce plus two other subjects	At least 2 Principal passes at 'A' level in Maths, Economics, Commerce and Accounting or in any other two approved subjects or their equivalent or 4 passes in Mature Age Entry Examination.	5 approved subjects at 'O' level plus 2 at 'A' Level.	Credit or distinction in the relevant Diploma or its equivalent.

BEST COPY AVAILABLE

COUNTRY	KENYA	ZAMBIA	TANZANIA	ZIMBABWE	MALAWI
Architecture:					
Certificate		Information not available	Information not available	Information not available	Information not available
Diploma		'O' Level Certificate	'O' or 'A' Level certificate		
Degree	At least a subsidiary pass at KACE in Pure Maths, Applied Maths, Physics and Fine Arts or Equivalent internationally recognised certificates.				

SOURCE: The Eastern and Southern Arican Universities Research Project:

The Inventory of Universities and Selected Tertiary Institutions in Eastern and Southern African Countries 1983:

APPENDIX 3

SOURCES OF INFORMATION

Women's Bureaus

The Co-ordinator
Women's Affairs
Women's Affairs Unit
Dept of Culture
Registration & Social Welfare Matters
Private Bag 00185
Gaborone
Botswana

Tel: 373967
Telex: 2414 BD

The Head
The Gambia National Women's Bureau
No 1, Marina Parade
The President's Office
State House
Banjul
The Gambia

The Secretary of State
c/o National Council on Women
and Development
P O Box M-53
Accra
Ghana

Tel: 229119
Telex: 2001 STAR
ie (Ministry of Foreign
Affairs)

The Director
Women's Bureau
Department of Social Services
Ministry of Culture & Social Services
P O Box 45958
Nairobi
Kenya

Tel: 339650
Tlx: 22696 FOREIGN NAIROBI

The Director for Youth
and Women's Affairs
PRIMIN (Youth & Women's Affairs)
P O Box 527
Maseru
Lesotho

The Secretary for Community Services
National Commission on Women in Development
Ministry of Community Services
Private Bag 330
Lilongwe 3
Malawi
Tel: 732222

The Principal Assistant Secretary
Ministry of Labour & Industrial Relations
Women's Rights and Family Welfare
4th Floor, Sugar Industry Labour
Welfare Fund Building
Edith Cavell Street
Port Louis
Mauritius
Tel: 23658
L Dubois Office
08 8250 or 082062-5
(Office-General)

Tlx: 4249 EXTERN IUU

Women & Children Development Division
Federal Ministry of Social Development,
Youth and Sports
5 Kofo Abayomi Road
Victoria Island
Lagos
Nigeria
Tel: 616075

The Chairperson
Seychelles Women's Council
P O Box 91
Victoria, Mahé
The Seychelles
Tel: 24289
Tlx: 2226 SPF SZ

The Chief Social Development Officer
Division of Social Services & Youth
Ministry of Health, Social Services & Youth
New England
Freetown
Sierra Leone
Tel: 41255
Tlx: MINWEL-Sierra Leone

The Secretary
Department of Community Development
Ministry for the Interior & Immigration
P O Box 432
Mbabane
Swaziland

The Secretary
Prime Minister's Office
P O Box 3021
Dar es Salaam

The Secretary-General
Jumuiya Ya Wanawake Wa Tanzania (UWT)
Makao Makuu
P O Box 825
Dodoma
Tanzania

The Principal for Community Development
Women's Leader's College
Rungemba
Tanzania

The Permanent Secretary
The Committee on Women & Development
Federal Ministry of Health
P O Box 7136
Kampala
Uganda

The Chairperson
Women's Affairs Committee
of Central Committee
United National Independence Party
Freedom House
P O Box 30302
Lusaka
Zambia
Tel: Lusaka 217344
Tlx: 43640

The Permanent Secretary
Ministry of Community Development
and Women's Affairs
5th Street, Chaminuka Building
Private Bag 7735
Causeway
Harare
Zimbabwe
Tel: 792351/3
79371/9
Tlx: 2141 ZW

National Councils for Science

Council for Science & Technology
P O Box M32
Accra
Ghana
Tel: 77651

National Council for Science & Technology
P O Box 30623
Nairobi
Kenya
Tel: 336173

National Research Council of Malawi (NRCM)
Private Bag 301
Lilongwe 3
Malawi

Tanzania National Scientific Research Council (NSRC)
P O Box 4302
Dar es Salaam
Tanzania
Tel: 25802
20351
21887
Telex: 41177 UTAFITI

National Research Council (NRC)
P O Box 6884
Kampala
Uganda
Tel: 241441/2
233817
Telex: 61117 EONOMY UGA

National Council for Scientific Research (NCSR)
P O Box CH 158
Cheston
Lusaka
Zambia
Tel: 281-081

Scientific Council of Zimbabwe
Scientific Liaison Office
P O Box 8510 CAUSEWAY
Harare
Zimbabwe
Tel: 700573
Telex: 2141 ZIMGOU ZW

Regional Institutions

The Commonwealth Association of Polytechnics in Africa (CAPA)

The Secretary General
CAPA Secretariat
P O Box 52428
Nairobi
Kenya

Tel: 338156
Tlx: 22529

East & Southern African Management Institute (ESAMI)

The Director
P O Box 3030
Arusha
Tanzania

Forum of Africa Science Educators (FASE)

The President
Forum of Africa Science Educators
c/o Faculty of Education
University of Nigeria
Nsukka
Anambra State
Nigeria

International

Association of Commonwealth Universities (ACU)

The Secretary-General
ACU
John Foster House
36 Gordon Square
London WC1H 0PF

Tel: 01 - 387 8572
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Education Programme
Human Resource Development Group
Marlborough House
Pall Mall
London SW1Y 5HX

Tel: 01 - 839 3411
Tlx: 27678
Fax: 01 - 930 0287

Women and Development Programme
Marlborough House
Pall Mall
London SW1Y 5HX

Tel: 01 - 839 3411
Tlx: 27678
Fax: 01 - 930 0287

Fellowships and Training Programme
Marlborough House
Pall Mall
London SW1Y 5HX

Tel: 01 - 839 3411
Tlx: 27678
Fax: 01 - 930 0287

Commonwealth Science Council
Marlborough House
Pall Mall
London SW1Y 5HX

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Tlx: 27678
Fax: 01 - 930 0287

Commonwealth Foundation
Marlborough House
Pall Mall
London SW1Y 5HX

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Tlx: 27678
Fax: 01 - 930 0287